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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF FORESTRY—BULLETIN No. 43.
CIFFORD PINCHOT, Forester.

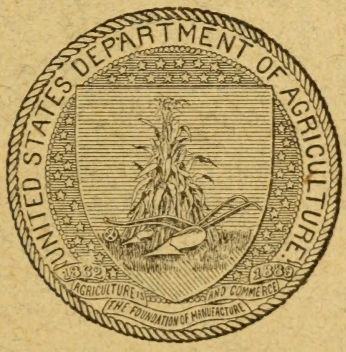
A WORKING PLAN

FOR

FOREST LANDS IN HAMPTON AND BEAUFORT COUNTIES, SOUTH CAROLINA.

BY

THOMAS H. SHERRARD,
Field Assistant, Bureau of Forestry.



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GIFFORD PINCHOT, *Forester.*

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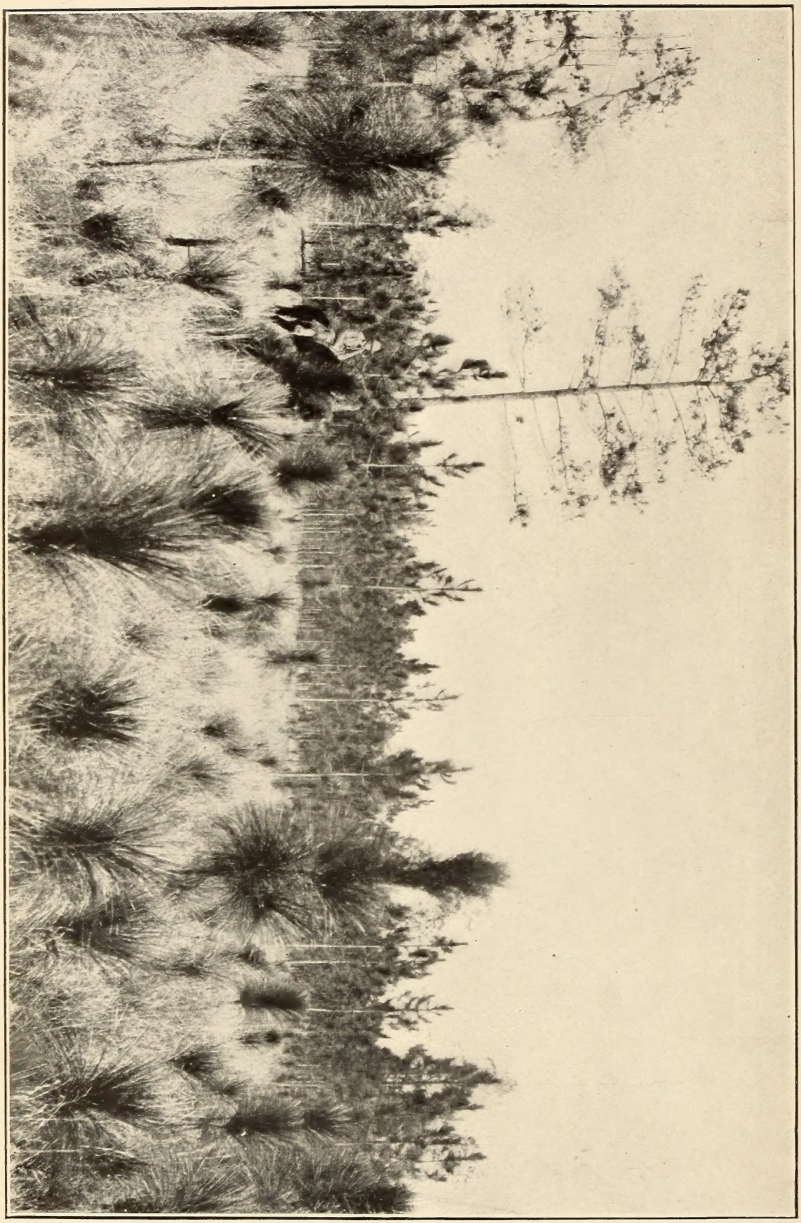

LONGLEAF PINE SEEDLINGS.

U. S. DEPARTMENT OF AGRICULTURE,

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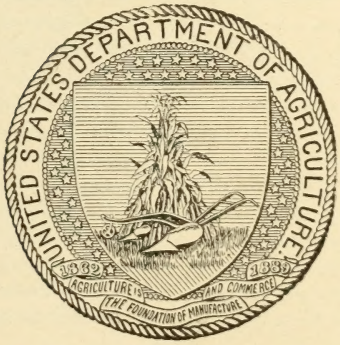

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1903.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Forestry,
Washington, D. C., June 27, 1903.

Sir: I have the honor to transmit herewith a report entitled "A Working Plan for Forest Lands in Hampton and Beaufort Counties, South Carolina," by Thomas H. Sherrard, field assistant in the Bureau of Forestry, and to recommend its publication as Bulletin No. 43 of the Bureau of Forestry.

The twelve plates, eleven text figures, and one map accompanying this bulletin are necessary for its proper illustration.

Very respectfully,

Gifford Pinchot, *Forester.*

Hon. James Wilson,
Secretary of Agriculture.

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A WORKING PLAN FOR FOREST LANDS IN HAMPTON AND BEAUFORT COUNTIES, S. C.

INTRODUCTION.

The working plan the results of which are presented in the following pages was made by the Bureau of Forestry of the United States Department of Agriculture, at the request of the Okeetee Gun Club, under the terms of the offer of cooperation contained in Circular No. 21. This offer of cooperation contemplates the establishment of examples of correct forest management under the varying conditions of different forest regions.

The tract of the Okeetee Gun Club is fairly typical of that portion of the South Atlantic coast plain which extends through the States of South Carolina and Georgia. This region is a low, perfectly flat country, only slightly above the level of the sea. It is characterized by poor, sandy soils and frequent swamps and savannahs. Farther inland the topography becomes rolling, soil and drainage conditions are entirely changed, and the forest assumes a very different character and development.

The Longleaf Pine was formerly the chief timber tree of this region. Now the supply of this timber is everywhere seriously diminished, and in most localities entirely gone. Some years ago the report was circulated that the timber resources of the coast were practically exhausted. The annual production of lumber and the capacity of the mills have nevertheless steadily increased. Among the circumstances which have sustained the lumber industry is the substitution of large improved mills, unexcelled in equipment, for the crude and wasteful sawmills which, here as elsewhere, were the pioneers of the industry. The era of the small mill was marked by enormous waste. Its use was profitable only so long as the supply of virgin timber was abundant. Improvement in methods of lumbering and in facilities for transportation have tended to a steadily increasing production of lumber. Furthermore, the rapid increase in the value of logs and lumber has steadily lowered the standard for merchantable timber, both in size and quality, and has led to the general substitution of the Loblolly and Cuban pines for the Longleaf.

The lumber industry in the coast region has now reached an era of marked intensiveness. There is no tract of merchantable timber

which is too distant or too difficult of access to be lumbered at a profit, while trees formerly considered unmerchantable are now accepted eagerly as substitutes for the Longleaf Pine. While the effect of these conditions will probably be to postpone for a short time the complete exhaustion of the pine, and while the exploitation of the hardwoods in the swamps, at present just beginning, will extend the period of lumbering operations, the end of the supply of first-growth timber in the coast region is plainly in sight.

Forestry can accomplish two things in this region: By conservative lumbering of the remaining forests it can avoid the utter destruction which has marked the lumbering of the Longleaf Pine; by protection from fire it can restore the productive power of the denuded Longleaf Pine lands.

THE TRACT.

DESCRIPTION OF THE TRACT.

The lands of the Okeetee Gun Club are situated in Beaufort and Hampton counties, S. C., about 30 miles northeast of Savannah. They comprise an area of approximately 60,000 acres. The tract, a map of which is shown at Plate XIII, is broken by interior holdings of about 4,660 acres. Consolidation of the club land, exceedingly desirable for the preservation and proper management of the woodlands, is the policy of the club to a limited extent only. The tract was purchased for the purposes of a gun club and for the preservation of quail. A certain number of fields in bird food is necessary, and the surest and cheapest way of securing them is by arrangement with residents living on their own little places.

The lands are crossed by the Southern Railroad and the Charleston and Savannah division of the Atlantic Coast Line system. These lines connect at Hardeeville.

The topography is monotonous. Low, flat sand plains, bordered by broad swamps along the streams and brooks, are characteristic features. From an altitude of about 30 feet at the highest point the land slopes almost imperceptibly west and south. Drainage is into the Savannah River, and, through the Great Swamp, directly into the salt marshes of the Atlantic coast. Many portions of the tract are subject to frequent overflow.

The soil is sand of varying depth over clay hardpan.

PAST OWNERSHIP AND TREATMENT.

The character of the present forest has been greatly influenced by the past treatment of the many private holdings into which the tract was cut before its purchase by the Okeetee Gun Club. Most important among the determining influences to which its character is due are agriculture, lumbering, turpentine gathering, and fire.

Agriculture began at an early date, and clearing for the raising of field crops has been extensive. But after the war the large rice and cotton fields were very generally abandoned, and many plantations have since grown up to young forest.

For many years the pine has been lumbered in a small way; the lumbering consisted in culling out the most desirable trees, especially the Longleaf Pine. This cutting, resembling what is technically known as the selection system, removed only the mature trees. The damage to the forest from lumbering alone was comparatively small, because there was left a large number of trees which in a short time would have grown to merchantable size. (Pl. II.) The culled forests, however, have been very largely destroyed by the turpentine gatherers and by fire.

THE ORIGINAL FOREST.

The original forest comprised two types, which are still distinctly marked, and which are the direct result of differences in soil and drainage. These were the forests of the dry sands and the forests of the swamps. The latter remain practically intact, but on the sands the character of the original forest has to be judged mainly by its remnants. The drier situations were formerly covered with a nearly pure forest of Longleaf Pine. The transition from Longleaf Pine land to swamp is sometimes abrupt; more often, however, there is a transition type which occupies the lower and moister pine lands and the hummocks within the swamps. Here the original growth included Loblolly, Cuban, and Pond pines. The swamp supports a varied growth, among which the characteristic trees are Cypress and the Gums.

THE PRESENT FOREST.

PINE LAND.

The present forest varies greatly. The swamps still retain their original character. But on the pine land, which forms altogether about two-thirds of the tract, the character of the growth has undergone a great change. Unbroken forest is the exception. The pine forest is largely composed of scattered groups of different ages, varying considerably in composition, density, and condition. Nevertheless, on cut-over land the tendency is strongly toward the reappearance of the same species which formed the old forest.

In general, the southern part of the tract, although slightly lower than the northern part, is better drained, and the pine lands belong to the Longleaf Pine type; while in the northern portion Loblolly and Cuban Pine greatly exceed Longleaf, both in the original forest and in the second growth. The Longleaf Pine type has suffered the greatest change, through lumbering, turpentine gathering, and fire.

The Longleaf Pine has been the tree of chief commercial value, and the effect of the closer cutting of this species has been completely to denude great areas.

The mixed pine forest, on the other hand, has been merely culled of its largest Loblolly and Cuban Pines, and their removal has seldom greatly diminished the density of the forest. On lands where the Longleaf Pine occurred in mixture with the other pines, the removal of the merchantable Longleaf Pine has left a sufficient number of trees to form the basis for another crop. With protection from fire, conditions would be favorable for the reproduction and renewal of the forest.

The effect of lumbering, turpentine boxing, and fire has been to decrease the former preponderance of forest of the Longleaf Pine type, and at present the largest part of the merchantable timber is Loblolly and Cuban Pine.

The merchantable pine forest comprises a few large bodies of fairly compact forest and a large amount of timber scattered along the margins of the many swamps and brooks. East of the Great Swamp, on the lands known as the English tract and Horse Island, Longleaf and Cuban Pine predominate. On the west side of the tract, along the Southern Railroad, the merchantable timber is chiefly Loblolly Pine. (Pl. IV.) Merchantable Cypress is confined to the Savannah River Swamp and the Great Swamp.

Of the whole tract of 60,000 acres, 20,000 acres have at some time been cleared. A large part of this is open field, which supports at most only scattered trees. A portion is under field crops; but most of it comprises exhausted fields and pastures, and cut-over forests and abandoned turpentine orchards which have been destroyed by fire. Reproduction is as a rule either entirely lacking or too scattered to promise a forest growth in the near future, owing to the recurrent fires which burn in the long grass and destroy the seedlings.

Natural reseeding can be effected only by the careful use of fires set with reference to the fall of seed and by subsequent protection from fires.

SECOND-GROWTH FOREST.

Especial interest, however, attaches to this area because of the remarkably promising second growth already upon the ground. The second-growth forest may be classed as seedlings, saplings, and poles. Young trees up to 10 feet in height are classed as seedlings; under saplings is included second growth composed of trees from 10 to 20 feet in height. By pole forests are meant forests in which the trees vary in diameter from 4 to 14 inches.

Under present conditions reproduction results only where there is accidental protection from fire. How the reseeding is effected will be explained later under the the discussion of forest fires.

CULLED LONGLEAF PINE FOREST.

ORIGINAL FOREST OF LONGLEAF PINE.

Longleaf Pine greatly predominates in the seedling growth on the dry sands which constitute Longleaf Pine land; it occurs both singly and in small scattered groups. On this type, seedlings of the Loblolly, Cuban, and Pond Pine are generally confined to abandoned fields where the turning under of the inflammable grass has afforded complete protection from fire for a time sufficient for the seedlings to have established themselves, and to have grown large enough to survive the light ground fires.

At once the most interesting and the most valuable of the second growth on Longleaf Pine land are the numerous groups of Longleaf Pine saplings and poles. These have sprung up in windfalls and other openings in the old forest, and, on account of the small size of the trees, have escaped the lumberman and the turpentine gatherer. They are important as forming a nucleus for the future forest on Longleaf Pine land. (Pls. V and VI.) To show the actual growth of these groups, all trees 1 inch and over in diameter at breastheight were counted and calipered on a small number of sample plots. The average diameter for each plot was determined, and one or more sample trees of this diameter and of normal development were felled. Measurements of these sample trees were used as the basis for computing the total volume and the growth per acre. A summary of these sample plots is given in the following table. The results show a highly satisfactory rate of growth, in spite of the unfavorable conditions, incident to frequent fires, under which it was made.

TABLE 1.—*Summary of measurements of stand, growth, and volume of groups of second-growth Longleaf Pine.*

Average diameter breast-high.	Number of plots.	Total area of plots.	Density.	Number of trees per acre.						Average height.	Average age.	Average clear length.	Average volume per acre.	
				Dominant.	Intermediate.	Overtopped.	Dead.	Under 1 inch.	Dominant intermediate overtopped.					
Inches.		*Acres.*								*Feet.*	*Years.*	*Feet.*	*Cubic feet.*	*Cords.*
2	2	0.135	0.6	777	259	37	7	27	1,073	15.0	15	7.5	.....	.....
3	2	.115	1.0	852	348	243	....	330	1,443	.....	20	12.6	308.02	3.42
	2	.370	.8	445	503	165	14	70	1,127	24.2	19	14.6	216.19	2.40
	5	1.120	.6	445	335	209	16	97	1,005	26.8	26	.....	194.06	2.15
4	3	1.350	.6	310	255	307	12	57	884	33.3	22	11.6	437.30	4.85
5	4	1.560	.7	397	215	315	57	.....	984	42.2	29	24.0	601.36	6.68
6	7	1.870	1.0	323	129	448	32	32	1,010	51.2	32	31.8	646.09	7.17
7	4	.810	.8	295	143	351	64	.....	853	58.4	35	39.7	1,440.80	16.01
	3	.410	.6	220	120	134	34	.....	528	51.7	30	31.2	955.41	10.61
8	5	1.520	.7	236	72	244	8	.....	552	57.7	33	34.0	1,750.33	19.44
9	6	1.730	.7	188	97	56	4	.....	341	64.5	36	38.4	1,576.67	17.52
10	1	.500	.5	65	14	61	1	.....	140	67.0	35	42.3	1,665.37	18.50
11	2	1.000	.7	121	26	30	9	.....	177	71.4	37	47.5	2,166.20	24.07

This table shows forcibly the value of the timber crop maturing on the land. The danger period has been safely passed. Severe fires scorch the smaller trees, but a destructive fire is rare. The yield from these groups can be made to return a high rate of interest on the investment represented by the lands, unless turpentine tapping is allowed entirely to destroy the trees for the sake of a small immediate gain.

In the sapling and pole stages the growth is very rapid, and in the struggle for supremacy a vast number of trees are crowded out between this time and the maturity of the forest. From the sapling period judicious thinning would largely increase the final yield, and would improve its quality by cutting out defective, crooked, and otherwise unpromising trees. It is probable that a market for cord wood for the railroads could be worked up which would make it possible to thin, if not at a profit, at least without a financial loss. But so long as there is no sale for the material which the thinnings would yield, the forests should be left to themselves.

On the low pine lands, where the Longleaf Pine disappears and the natural forest belongs to the transition type of Loblolly, Cuban, and Pond Pine, second growth is largely limited to lands formerly tilled. Sapling and pole forests, dating from the general suspension of planting which followed the civil war, are numerous. Loblolly Pine is the commonest tree in these groups. It has succeeded in restocking small areas to the exclusion of the other species, forming miniature pure forests. Pond Pine occurs with the Loblolly in small groups and by single trees. The proportion of Pond Pine increases greatly upon lands which are frequently overflowed. Cuban Pine will grow on any land not too dry for the Loblolly, but most of the second growth of this species occurs in dense thickets bordering the Cypress ponds and small swamps.

SWAMP.

About one-third of the total area of the tract is swamp land. Unlike the open pine forests, the forests of the swamps are naturally dense, and have been left practically intact. The principal swamps are the River Swamp, which borders the Savannah River, and the Great Swamp, which traverses the eastern portion of the tract from north to south. The swamp forests consist chiefly of the deciduous hardwoods Sweet, Black, and Tupelo Gum, Water Ash, Water and Willow Oak, and Red Maple; the evergreen hardwoods Magnolia, Bay, and Live Oak; and the softwoods Cypress, Loblolly, and Cuban Pine. The pines are properly not swamp trees, but occur on knolls or hummocks within the swamps.

The bulk of the forest consists of Cypress and Gums, the largest of which are found in the wettest portions of the main swamps, where, on

account of faulty drainage and frequent overflow, the soil is constantly wet. Where the soil is subject to drying out, and true swamp conditions consequently fail, the trees are small, and the Cypress often disappears entirely.

The best Cypress has been cut from the river swamp and floated out on high water down the Savannah River. Openings made in the forest by the removal of Cypress generally fill up with a young growth of Gums. Pole Cypress and Gums are very common in groups of varying size in the small swamps, or "Cypress ponds," and in shallow portions of the main swamps. Here frequent drying out of the subsoil renders trees of merchantable dimensions comparatively rare.

The expense of a working plan for swamp land would be out of proportion to the results to be expected. Under present market conditions hardwood stumpage has small value, and the only practicable means of utilizing the hardwood timber would be to establish a large plant for the manufacture of hardwood utensils. It is not improbable, however, that the hardwoods will eventually prove to be as important commercially as the pines.

The forests of the swamps would be benefited silviculturally by cutting out the mature trees, both hardwoods and Cypress. At present the forest is very irregular; trees of all ages occupy the ground together. Annual growth is more than counterbalanced by annual decay. This working plan recommends that the Cypress be cut to a diameter limit of 18 inches. If the hardwoods could be sold and lumbered according to a definite plan it would be advisable to lumber the hardwoods to a diameter limit of 18 or 20 inches, but it is unlikely that they could be lumbered at present in a systematic and satisfactory manner.

DIVISION INTO BLOCKS.

A careful estimate was made of the pine timber east of the Great Swamp. This body of timber was divided into three blocks. Block 1, area 4,769 acres, includes the timber in the southern portion of this part of the tract. It has been recently boxed for turpentine. Block 2, area 4,430 acres, includes the timber to the northward which has not been boxed. Block 3, area 1,952 acres, includes scattered lots which have been cut over. No attempt was made to estimate all the timber on the tract. Two other blocks, however, were selected. Block 4, area 2,907 acres, includes a portion of the Great Swamp. Block 5, area 4,065 acres, includes the Loblolly timber on the western portion of the tract, along the Southern Railroad. (See map, Pl. XIII.)

METHOD OF THE ESTIMATE.

TABLES OF STAND.

In order to arrive at an accurate basis for estimating the present stand of timber in these blocks, valuation surveys were made. Strip acres 10 chains long and 1 chain wide were run on compass courses through the blocks, and all trees standing upon these strips, including pine down to 1 inch in diameter and Cypress and hardwoods down to 10 inches, were calipered, and their diameters recorded separately for each acre surveyed. Six hundred and fifty-eight acres were thus measured, distributed as follows:

Block 1, 239 acres, or 5 per cent of the area.
Block 2, 169 acres, or 3.8 per cent of the area.
Block 3, 80 acres, or 4.1 per cent of the area.
Block 4, 96 acres, or 3.3 per cent of the area.
Block 5, 74 acres, or 1.8 per cent of the area.

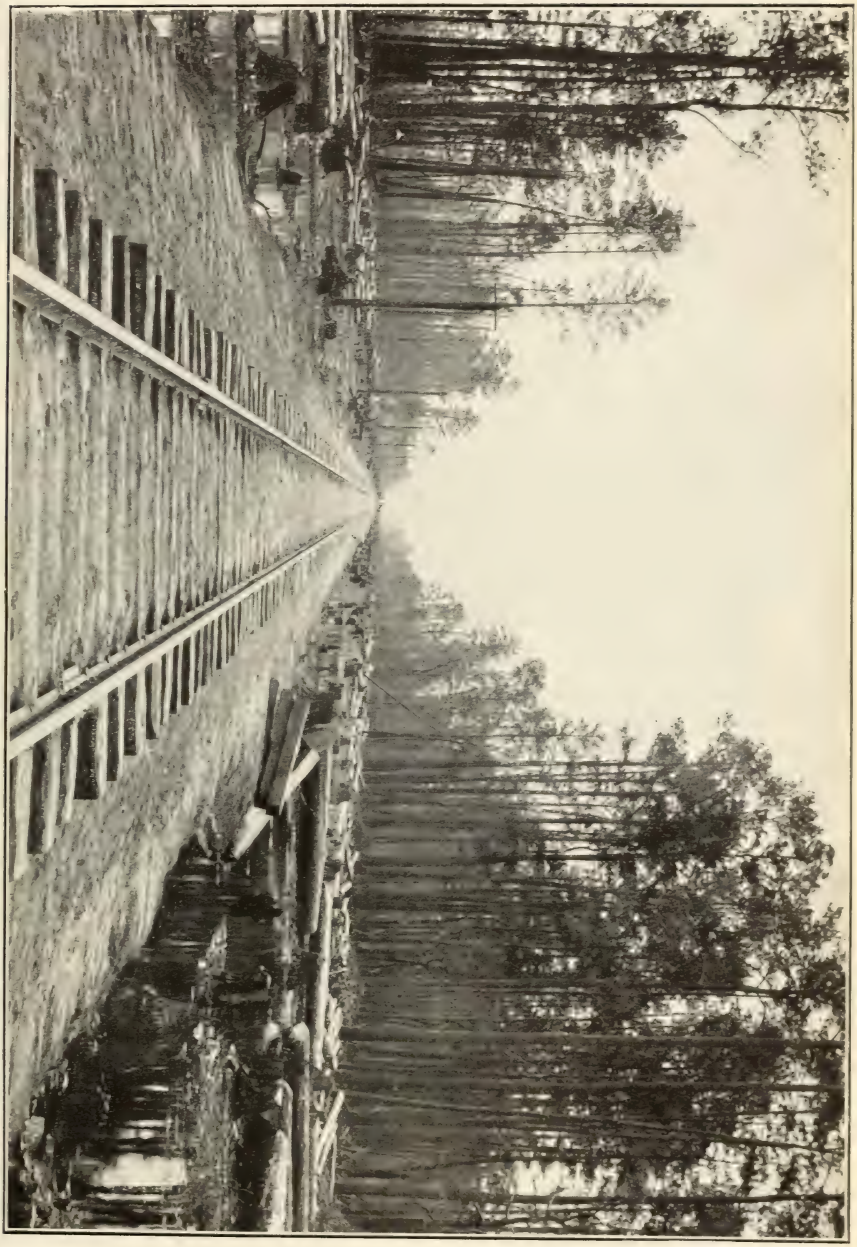
Tables 2 to 6 (pp. 15–19) were constructed from the valuation surveys. They show for each block the average number of trees per acre, by inch classes, of pine 1 inch and over in diameter, and of Cypress and hardwoods 10 inches and over in diameter breasthigh, and the total number of trees.

A summary of each table for all trees 12 inches and over in diameter breasthigh shows the average number of trees, the percentage of each species, and the average diameter of each species. In all the tables, Longleaf and Cuban Pines have been separated into boxed and unboxed trees.

These tables of stand are not strictly representative of forest types. It was found that the areas representing single types were often of small extent and of scattered distribution. On this account, and owing to the great variation within the same type, due to the past management of the forests, it was thought advisable to run the strip acres on compass courses rather than to attempt to follow a rigid division upon type lines. The name given a table is, however, indicative of the forest type which predominates upon the lands included within the block to which the table applies.

Tables 2, 3, and 4 were compiled from acre measurements the majority of which were made on pine land. Tables 5 and 6 were based on acre measurements made largely in swamp and Loblolly Pine forest, respectively.

Block 1. Boxed pine land.—The bulk of the forest in Block 1 is pure Longleaf Pine. A small stand of swamp trees is found along the streams and in the cypress ponds. Cuban, Loblolly, and Pond Pines border the swamps and occur on low flats of varying size. The average number of pine trees of all diameters per acre, omitting dead pine, is 88.16, of which 58.30, or over 66 per cent, are Longleaf Pine.



LOBLOLLY PINE FOREST.

FIG. 1.—THICKET OF LONGLEAF PINE SAPLINGS.

FIG. 2.—INTERIOR VIEW OF LONGLEAF PINE THICKET.

The table shows that only 10.58 trees, or about 18 per cent, of Longleaf Pine are 12 inches and over in diameter, while 47.72, or nearly 82 per cent, are from 1 to 11 inches in diameter. This small representation of Longleaf Pine of large diameters is due to a severe wind storm in the spring of 1898, which blew down a great many large Longleaf Pine trees. The damage from the storm was almost entirely to large trees. The large stand of Longleaf Pine from 6 to 20 inches in diameter which was left after the storm promised a second crop of timber within a short period, in which there would have been a greatly increased proportion of Longleaf Pine. This fact was particularly striking on examination upon the ground, because the forest is interrupted by many small openings which are entirely without timber, while the trees occur in dense groups which completely stock the ground on which they stand, and were growing under the most favorable conditions. Soon after the storm, however, 88 per cent of the Longleaf Pine 9 to 20 inches in diameter were boxed for turpentine, while trees as small as 6 inches were boxed. As explained elsewhere, boxed trees can not be considered to form the basis for another crop, and should, so far as possible, be removed in the cuttings.

Below 6 inches there is a falling off in the proportionate number of trees, which is probably due to the frequent fires during the last forty years. While the stand of small trees which remain unboxed in this block is inadequate to promise a second crop of timber in the near future, it is large enough to justify protection from fire, with the object of reestablishing the forest through reproduction.

Block 2. Unboxed pine land.—In addition to bays or arms of the Great Swamp, Block 2 includes many sloughs along which are wooded swamps. (See map, Pl. XIII.) The large percentage of swamp trees shown in the table of stand for the block is due to the presence of these many swamps.

The stand of pine is small, not only because of the large area of swamp land, but also because of many large openings in the pine forest, which are the result of old lumbering and turpentining and of damage by fire and wind. The boxing for turpentine was done over scattered areas. These are now marked by openings in the forest or by scattered dead trees and burnt stubs. The dead Longleaf Pines shown in the table of stand occur on these areas.

There is very little Longleaf Pine in Block 2. Most of the pine land is low and poorly drained, and supports Cuban, Loblolly, and Pond Pines.

Owing to the destruction of many small trees by boxing and fire, the representation of pine 12 inches and under in diameter is disproportionally small. Reseeding of openings in the forest has been prevented by fires, while within the dense groups of timber reproduction is impossible because of lack of sufficient light. It is advised

that the groups be opened up by the removal of the mature trees and that the whole block be protected from fire.

Block 3. Cut-over pine land.—This block has all been lumbered recently, and the cutting was comparatively close. The large percentage of Cypress and Gums—34.5 per cent of all trees 12 inches and over in diameter—is explained by the cutting out of most of the large pines. There is a fair stand of small unboxed pine, which it should be the first object of the management to protect from fire.

Block 4. Swamp land.—This table, unlike the other tables of stand, is based upon acre measurements which were made entirely within one forest type, which is fairly typical of the mature swamp forest on this tract. Sweet and Black Gum and Cypress together comprise 94 per cent of the trees 12 inches and over in diameter. Although the Gums greatly outnumber all other species, the commercial importance of the forest in this block lies at present entirely in the large number of merchantable Cypress.

The swamp forest is exceedingly dense, as is indicated by the large number of trees per acre 12 inches and over in diameter, and the crowns of the trees admit very little light.

The effect of lumbering the merchantable Cypress would be beneficial to the forest by breaking the dense cover of the crowns and allowing light to reach the undergrowth. The cutting of mature hardwoods would be much more effective, owing to their greater number; but lumbering of hardwoods is at present impracticable.

Block 5. Loblolly Pine land.—The forest in which were made the acre measurements upon which this table of stand is based consists largely of pure Loblolly Pine and Loblolly Pine in mixture with oaks. The small stand of Cuban Pine occurs in small groups or scattered by single trees throughout the block. This block includes also small areas of swamp and Longleaf Pine land. Many years ago the largest Cuban and Longleaf Pines were cut out.

The table shows that there are 8.90 Loblolly Pines per acre from 1 to 9 inches in diameter, while there are 11.30 Loblolly Pines from 10 to 18 inches in diameter. The proportionate representation of diameter classes is the reverse of what it should be if the proportion of Loblolly Pine in the mixture is not to suffer by the removal of the large trees. This scarcity of young growth of Loblolly Pine is due to the dense cover which the crowns of the large trees afford, and to the annual fires, which destroy great numbers of small Loblolly Pines. The management indicated for this block is the opening up of the forest by the removal of the larger trees and the protection of young growth for a time sufficient for a new forest to become established.

TABLE 2.—*Present stand. Block 1—Boxed pine land.*

[Pine 1 inch and over in diameter breasthigh: Cypress and hardwoods 10 inches and over in diameter breasthigh.]

Diameter breasthigh (inches).	Average number of trees per acre.													
	Longleaf Pine.			Cuban Pine.			Pond Pine.	Loblolly Pine.	Gums.	Cypress.	Dead Longleaf Pine.	Red Maple.	Swamp oaks.	All species.
	Unboxed.	Boxed.	Total.	Boxed.	Unboxed.	Total.								
1	3.81	.....	3.81	.....	0.33	0.33	0.09	0.66	.....	.....	0.01	.....	.....	4.90
2	7.36	.....	7.36	.....	.86	.86	.21	.74	.....	.....	.....	.....	.....	9.17
3	7.84	.....	7.84	.....	1.11	1.11	.34	.56	.....	.....	.....	.....	.....	9.85
4	6.42	.....	6.42	.....	1.07	1.07	.44	.38	.....	.....	.....	.....	.....	8.31
5	5.11	.....	5.11	.....	.74	.74	.54	.36	.....	.....	.....	.....	.....	6.75
6	4.14	0.03	4.17	0.01	.57	.58	.76	.20	.....	.....	.01	.....	.....	5.72
7	3.49	.12	3.61	.02	.42	.44	.77	.27	.....	.....	.....	.....	.....	5.09
8	2.43	.60	3.03	.10	.28	.38	.70	.18	.....	.....	.01	.....	.....	4.30
9	1.03	1.20	2.23	.24	.15	.39	1.03	.20	.....	.....	.01	.....	.....	3.86
10	.31	1.80	2.11	.27	.14	.41	.94	.24	0.69	0.65	.15	0.22	.....	5.41
11	.17	1.86	2.03	.31	.09	.40	.92	.22	.68	.42	.12	.13	0.01	4.93
12	.08	1.74	1.82	.30	.08	.38	.79	.23	.62	.43	.20	.07	.01	4.55
13	.10	1.71	1.81	.36	.06	.42	.63	.20	.39	.26	.21	.06	.01	3.99
14	.08	1.34	1.42	.50	.05	.55	.50	.25	.39	.28	.18	.05	.01	3.63
15	.07	1.26	1.33	.61	.08	.69	.35	.16	.30	.17	.26	.02	.....	3.28
16	.07	1.13	1.20	.53	.02	.55	.23	.15	.24	.14	.20	.04	.....	2.75
17	.04	.90	.94	.64	.02	.66	.13	.14	.20	.10	.17	.02	.02	2.38
18	.03	.61	.64	.72	.03	.75	.06	.19	.17	.11	.14	.....	.....	2.06
19	.02	.43	.45	.62	.04	.66	.05	.18	.13	.05	.15	.....	.....	1.67
20	.01	.32	.33	.58	.02	.60	.02	.13	.10	.10	.12	.01	.....	1.41
21	.....	.23	.23	.53	.03	.56	.03	.13	.08	.05	.09	.....	.....	1.17
22	.01	.13	.14	.37	.02	.39	.02	.09	.05	.03	.09	.....	.....	.81
23	.....	.10	.10	.29	.02	.31	.01	.12	.05	.05	.06	.....	.....	.70
24	.....	.05	.05	.18	.01	.19	.....	.07	.03	.03	.06	.....	.....	.43
25	.....	.05	.05	.17	.....	.17	.....	.05	.01	.03	.06	.....	.....	.37
26	.....	.03	.03	.12	.01	.13	.....	.08	.01	.02	.02	.....	.....	.29
27	.....	.03	.03	.10	.....	.10	.....	.07	.....	.03	.05	.....	.....	.28
28	.....	.....	.....	.05	.....	.05	.....	.04	.01	.01	.02	.....	.....	.13
29	.....	.01	.01	.03	.....	.03	.....	.03	.....	.03	.03	.....	.....	.13
30	.....	.....	.....	.....	.....	.....	.....	.01	.01	.01	.....	.....	.....	.03
31	.....	.....	.....	.02	.....	.02	.....	.02	.....	.....	.01	.....	.....	.05
32	.....	.....	.....	.01	.....	.01	.....	.01	.....	.01	.....	.....	.....	.03
34	.....	.....	.....	.01	.....	.01	.....	.....	.....	.01	.....	.....	.....	.02
36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....	.01
38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....	.01
Total	42.62	15.68	58.30	7.69	6.25	13.94	9.56	6.36	4.16	3.04	2.43	.62	.06	98.47

SUMMARY OF TREES 12 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total	0.51	10.07	10.58	6.74	0.49	7.23	2.82	2.35	2.79	1.97	2.12	0.27	0.05	30.18
Per cent	1.69	33.37	35.06	22.33	1.62	23.95	9.34	7.79	9.24	6.53	7.02	.90	.17	100.00
Average diameter	14.9	14.4	14.4	18.1	17.2	18.0	14.3	19.2	15.8	17.5	18.2	14.3	14.8	.....

TABLE 3.—*Present stand. Block 2—Unboxed pine land.*

[Pine 1 inch and over in diameter breasthigh; Cypress and hardwoods 10 inches and over in diameter breasthigh.]

Diameter breasthigh (inches).	Average number of trees per acre.														
	Cuban Pine.			Cypress.	Loblolly Pine.	Gums.	Pond Pine.	Dead Longleaf Pine.	Longleaf Pine.			Red Maple.	Shortleaf Pine.	Swamp oaks.	All species.
	Unboxed.	Boxed.	Total.						Unboxed.	Boxed.	Total.				
1	0.80	.....	0.80	.....	0.04	.....	0.04	.....	0.05	.....	0.05	.....	.....	.....	0.93
2	1.11	0.02	1.13	.....	.08	.....	.16	.....	.04	.....	.04	.....	.....	.....	1.41
3	1.53	.....	1.53	.....	.17	.....	.12	.....	.02	.....	.02	.....	.....	.....	1.84
4	1.24	.03	1.27	.....	.18	.....	.16	.....	.06	.....	.06	.....	0.01	.....	1.68
5	1.18	.02	1.20	.....	.21	.....	.18	.....	.04	.....	.04	.....	.....	.....	1.63
6	1.04	.02	1.06	.....	.18	.....	.18	.....	.05	.....	.05	.....	.....	.....	1.47
7	.72	.02	.74	.....	.32	.....	.18	.....	.08	.....	.08	.....	.01	.....	1.33
8	.90	.04	.94	.....	.34	.....	.22	.....	.05	.....	.05	.....	.01	.....	1.56
9	.85	.01	.86	.....	.22	.....	.14	.....	.04	0.01	.05	.....	.08	.....	1.35
10	.87	.04	.91	2.17	.28	0.43	.29	0.02	.06	.....	.06	0.07	.02	0.02	4.27
11	.63	.02	.65	1.36	.20	.31	.20	.03	.03	.01	.04	.07	.01	.01	2.88
12	.59	.02	.61	.88	.21	.33	.18	.05	.02	.....	.02	.11	.01	.02	2.42
13	.75	.07	.82	.85	.17	.37	.20	.02	.02	.....	.02	.04	.01	.01	2.51
14	.63	.10	.73	.44	.20	.18	.21	.06	.02	.....	.02	.05	.....	.03	1.92
15	.67	.09	.76	.38	.23	.18	.08	.04	.02	.....	.02	.02	.....	.....	1.71
16	.53	.07	.60	.27	.18	.17	.06	.06	.01	.....	.01	.01	.....	.....	1.36
17	.41	.08	.49	.16	.15	.12	.05	.08	.01	.....	.01	.03	.....	.....	1.09
18	.34	.06	.40	.11	.21	.11	.01	.09	.....	.01	.01	.....	.....	.....	.94
19	.30	.07	.37	.05	.16	.08	.01	.07	.01	.01	.02	.01	.....	.02	.79
20	.28	.08	.36	.04	.14	.05	.02	.10	.01	.....	.01	.01	.....	.01	.74
21	.24	.07	.31	.05	.14	.01	.02	.05	.....	.01	.01	.01	.....	.01	.61
22	.21	.09	.30	.04	.13	.04	.02	.05	.....	.01	.01	.01	.....	.01	.61
23	.19	.04	.23	.01	.13	.03	.01	.04	.....	.....	.....	.....	.....	.01	.46
24	.12	.05	.17	.01	.07	.01	.....	.04	.....	.....	.....	.01	.....	.....	.31
25	.15	.03	.18	.03	.08	.....	.....	.05	.....	.....	.....	.....	.....	.....	.34
26	.14	.02	.16	.01	.10	.....	.....	.03	.....	.01	.01	.....	.....	.....	.31
27	.05	.02	.07	.01	.10	.....	.....	.02	.....	.....	.....	.....	.....	.....	.20
28	.07	.01	.08	.01	.07	.....	.....	.05	.....	.01	.01	.....	.....	.....	.22
29	.05	.01	.06	.....	.04	.....	.....	.01	.....	.....	.....	.....	.....	.....	.11
30	.04	.01	.05	.....	.04	.....	.....	.01	.....	.....	.....	.....	.....	.....	.10
31	.02	.....	.02	.....	.09	.01	.....	.04	.....	.....	.....	.....	.....	.....	.16
Total..	16.65	1.21	17.86	6.88	4.86	2.43	2.74	1.01	.64	.08	.72	.45	.16	.15	37.26

SUMMARY OF TREES 12 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	5.78	0.99	6.77	3.35	2.64	1.69	0.87	0.96	0.12	0.06	0.18	0.31	0.02	0.12	16.91
Per cent	34.18	5.85	40.03	19.81	15.61	9.99	5.15	5.68	.71	.36	1.07	1.83	.12	.71	100.00
Average diameter ...	17.7	19.3	.....	14.6	21.1	15.4	14.6	20.8	19.6	22.6	20.6	15.1	12.5	17.4	.....

GROUPS OF LONGLEAF PINE POLES.

SOUND LOBLOLLY PINE LOG LEFT IN THE WOODS, 45 FEET LONG, 15 INCHES IN DIAMETER AT SMALL END.

TABLE 4.—*Present stand. Block 3—Cut-over pine land.*

[Pine 1 inch and over in diameter breasthigh; Cypress and hardwoods 10 inches and over in diameter breasthigh.]

Diameter breasthigh (inches).	Average number of trees per acre.													
	Longleaf Pine.			Cuban Pine.			Pond Pine.	Cypress.	Gums.	Loblolly Pine.	Dead Longleaf Pine.	Live Oak.	Red Maple.	All species.
	Unboxed.	Boxed.	Total.	Unboxed.	Boxed.	Total.								
1	4.42	.....	4.42	3.99	.....	3.99	0.58	.....	.....	0.15	.....	.....	.....	9.14
2	4.12	.....	4.12	4.42	.....	4.42	.74	.....	.....	.25	.....	.....	.....	9.53
3	3.27	.....	3.27	2.74	.....	2.74	.86	.....	.....	.13	.....	.....	.....	7.00
4	3.02	.....	3.02	1.94	.....	1.94	.99	.....	.....	.09	.....	.....	.....	6.04
5	2.51	.....	2.51	1.63	.....	1.63	.80	.....	.....	.10	.....	.....	.....	5.04
6	2.24	.....	2.24	1.45	.....	1.45	.83	.....	.....	.05	.....	.....	.....	4.57
7	1.73	.....	1.73	1.48	0.01	1.49	1.06	.....	.....	.06	.....	.....	.....	4.34
8	1.45	.....	1.45	1.11	.08	1.19	.95	.....	.....	.04	.....	.....	.....	3.63
9	1.19	0.05	1.24	.93	.09	1.02	1.08	.....	.....	.03	.....	.....	.....	3.37
10	.66	.04	.70	.83	.19	1.02	1.01	0.59	0.31	.01	0.01	.....	.....	3.65
11	.26	.06	.32	.54	.18	.72	.80	.64	.20	.04	.10	.....	0.01	2.83
12	.26	.09	.35	.33	.25	.58	.64	.43	.13	.04	.10	.....	.....	2.27
13	.06	.01	.07	.14	.19	.33	.30	.50	.24	.04	.11	.....	.....	1.59
14	.05	.05	.10	.10	.29	.39	.35	.50	.20	.04	.06	.....	.....	1.64
15	.03	.13	.16	.29	.08	.28	.24	.59	.14	.01	.10	.....	.....	1.52
16	.....	.09	.09	.09	.18	.27	.16	.31	.04	.03	.08	.....	.....	.98
17	.05	.08	.13	.08	.19	.27	.13	.21	.05	.....	.06	.....	.....	.85
18	.06	.04	.10	.06	.09	.15	.08	.11	.04	.01	.08	.....	.....	.57
19	.04	.01	.05	.08	.14	.22	.03	.21	.01	.04	.05	.....	.....	.61
20	.01	.01	.02	.03	.18	.21	.....	.10	.....	.01	.11	.....	.....	.45
21	.03	.....	.03	.....	.15	.15	.01	.05	.....	.03	.01	0.01	.....	.29
22	.....	.....	.....	.01	.09	.10	.....	.03	.01	.03	.06	.....	.....	.23
23	.....	.....	.....	.04	.11	.15	.....	.03	.....	.....	.06	.....	.....	.24
24	.01	.01	.02	.04	.03	.07	.....	.03	.....	.01	.01	.....	.....	.14
25	.....	.....	.....	.....	.03	.03	.....	.....	.....	.....	.03	.....	.....	.06
26	.....	.....	.....	.....	.05	.05	.....	.01	.....	.....	.01	.....	.....	.07
27	.....	.....	.....	.01	.....	.01	.....	.01	.....	.....	.01	.01	.....	.04
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.03	.....	.....	.04
29	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....	.....	.....	.01
30	.....	.....	.....	.....	.01	.01	.....	.....	.....	.....	.....	.....	.....	.01
Total	25.47	.67	26.14	22.27	2.61	24.88	11.64	4.36	1.37	1.25	1.08	.02	.01	70.75

SUMMARY OF TREES 12 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total	0.60	0.52	1.12	1.21	2.06	3.27	1.94	3.13	0.86	0.30	0.97	0.02		11.61
Per cent	5.17	4.48	9.65	10.42	17.75	28.17	16.71	26.96	7.41	2.58	8.35	.17		100.00
Average diameter	15.0	15.5	15.3	15.7	17.6	17.0	14.1	15.5	14.3	17.6	18.2	24.2	.....	.....

TABLE 5.—*Present stand. Block 4—Swamp.*

[Pine 1 inch and over in diameter breasthigh; Cypress and hardwoods 10 inches and over in diameter breasthigh.]

Diameter breasthigh (inches).	Average number of trees per acre.										
	Gums.	Cypress.	Red Maple.	Loblolly Pine.	Cuban Pine.			Spruce Pine.	Swamp oaks.	Pond Pine.	All species.
					Unboxed.	Boxed.	Total.				
1				0.18	0.01		0.01				0.19
2				.28			.01				.28
3				.17	.03		.03				.20
4				.06				0.01			.07
5				.08				.03			.11
6				.01				.01			.02
7				.03	.01		.01	.05			.09
8				.01				.01			.02
9				.01						0.01	.02
10	8.45	1.85	0.43	.05	.05		.05	.01	0.01		10.85
11	6.30	2.31	.17	.01	.05		.05				8.84
12	6.41	2.37	.38	.05				.01			9.22
13	5.90	1.90	.23	.05	.03		.03	.01	.01		8.13
14	5.56	2.08	.17	.01	.05		.05		.01		7.88
15	6.20	1.39	1.31	.05	.03		.03				8.98
16	4.28	1.08	.22	.05	.05		.05				5.68
17	3.36	1.01	.06	.01	.05	0.01	.06				4.50
18	3.75	.82	.11	.01	.07		.07				4.76
19	2.74	.56	.06	.01	.07		.07				3.44
20	2.11	.45	.09	.03	.08		.08				2.76
21	1.29	.40	.05		.07		.07				1.81
22	1.31	.21	.01		.01		.01	.01	.01		1.56
23	.88	.16	.01					.01			1.06
24	.62	.15	.05	.01	.01		.01				.84
25	.80	.25	.01								1.06
26	.48	.11	.01	.05		.01	.01				.66
27	.38	.06	.01	.03		.01	.01				.49
28	.15	.17	.01								.33
29	.11	.04		.03							.18
30	.23	.16	.01								.40
31	.03	.13	.05	.01							.22
32	.06	.15									.21
33	.05	.08		.01							.14
34	.08	.07		.01							.16
35	.01	.09									.10
36	.03	.03									.06
37		.01									.01
38	.01	.02									.03
39		.01									.01
40		.14									.14
42		.04									.04
44		.03									.03
45		.03									.03
50		.01									.01
Total	61.58	18.37	3.45	1.31	.67	.03	.70	.16	.04	.01	85.62

SUMMARY OF TREES 12 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total	46.83	14.21	2.85	0.42	0.52	0.03	0.55	0.04	0.03		64.93
Per cent	72.12	21.88	4.39	.65	.80	.05	.85	.06	.05		100.00
Average diameter	16.8	18.2	16.1	21.3	18.1	23.8	20.6	17.5	15.9		

TABLE 6.—*Present stand. Block 5—Loblolly Pine land.*

[Pine 1 inch and over in diameter breasthigh, hardwoods 10 inches and over in diameter breasthigh.]

Diameter breasthigh (inches).	Average number of trees per acre.													
	Loblolly Pine.	Cuban Pine.			Swamp oaks.	Spruce Pine.	Gums.	Pond Pine.	Longleaf Pine.				Red Maple.	All species.
		Unboxed.	Boxed.	Total.					Unboxed.	Boxed.	Total.	Dead.		
1	3.13	0.77	.....	0.77	.....	0.23	.....	0.30	0.23	.....	0.23	0.03	.....	4.69
2	1.57	.87	.....	.87	.....	.77	.....	.30	.47	.....	.47	.....	.....	3.98
3	.50	.73	.....	.73	.....	.70	.....	.....	.10	.....	.10	.....	.....	2.03
4	.43	.70	.....	.70	.....	.97	.....	.20	.13	.....	.13	.03	.....	2.46
5	.53	.70	.....	.70	.....	.63	.....	.13	.40	.....	.40	.....	.....	2.39
6	.67	1.10	.....	1.10	.....	.77	.....	.03	.03	.....	.03	.....	.....	2.60
7	.57	.90	.....	.90	.....	.70	.....	.33	.03	0.03	.06	.....	.....	2.56
8	.70	1.30	0.03	1.33	.....	.23	.....	.16	.13	.....	.13	.....	.....	2.55
9	.80	.67	.....	.67	.....	.07	.....	.10	.03	.....	.03	.....	.....	1.67
10	1.47	.31	.03	.34	0.95	.12	0.97	.14	.03	.....	.03	.....	0.18	4.20
11	1.18	.18	.08	.26	1.12	.08	.84	.14	.03	.01	.04	.01	.16	3.83
12	1.11	.08	.04	.12	.86	.12	.60	.07	.....	.01	.01	.04	.07	3.00
13	1.19	.04	.07	.11	.81	.05	.61	.07	.01	.01	.02	.03	.07	2.96
14	1.12	.09	.12	.21	.72	.05	.45	.07	.01	.03	.04	.04	.03	2.73
15	1.32	.09	.14	.23	.68	.05	.42	.....	.01	.....	.01	.08	.08	2.87
16	1.26	.07	.09	.16	.41	.07	.26	.01	.01	.....	.01	.08	.09	2.32
17	1.42	.09	.08	.17	.41	.01	.31	.04	.01	.01	.02	.01	.04	2.43
18	1.26	.08	.16	.24	.35	.05	.15	.03	.01	.01	.02	.07	.01	2.18
19	1.36	.01	.09	.10	.14	.03	.14	.....	.....	.01	.01	.08	.03	1.89
20	1.34	.01	.08	.09	.15	.03	.09	.01	.....	.01	.01	.05	.01	1.78
21	1.04	.01	.08	.09	.11	.....	.01	.....	.....	.03	.03	.09	.03	1.40
22	.85	.05	.01	.06	.12	.01	.05	.....	.....	.....	.....	.07	.01	1.17
23	.89	.03	.01	.04	.04	.....	.03	.01	.....	.....	.....	.09	.....	1.10
24	.58	.03	.04	.07	.03	.01	.....	.....	.....	.....	.....	.03	.....	.72
25	.51	.03	.....	.03	.04	.....	.05	.....	.....	.....	.....	.04	.....	.67
26	.39	.01	.....	.01	.04	.....	.....	.....	.....	.....	.....	.04	.....	.48
27	.31	.....	.01	.01	.08	.....	.....	.....	.01	.....	.01	.03	.....	.44
28	.18	.....	.....	.....	.01	.....	.....	.....	.01	.....	.01	.01	.....	.21
29	.18	.....	.01	.01	.....	.....	.....	.....	.....	.....	.....	.....	.01	.20
30	.19	.....	.....	.....	.01	.....	.....	.....	.....	.....	.....	.03	.....	.23
31	.07	.....	.01	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.08
32	.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.09
33	.07	.....	.....	.....	.01	.....	.....	.....	.....	.....	.....	.....	.....	.08
34	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01
35	.03	.....	.01	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.04
36	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.02
37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.01
Total	28.30	8.95	1.19	10.14	7.09	5.75	4.98	2.14	1.69	0.16	1.85	1.00	0.82	62.07

SUMMARY OF TREES 12 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total	16.75	0.72	1.05	1.77	5.02	0.48	3.17	0.31	0.08	0.12	0.20	0.93	0.48	29.11
Per cent	57.54	2.47	3.61	6.08	17.25	1.65	10.89	1.07	.27	.41	.68	3.19	1.65	100.00
Average diameter	19.3	17.7	18.00	17.9	17.9	15.6	15.2	15.00	19.3	17.3	18.1	20.8	16.1	.....

VOLUME TABLES.

The following tables, giving the average merchantable volume of standing timber in board feet by the Two-thirds Rule, on a basis of diameter at breastheight, were used in scaling the valuation surveys. The tables for pine are based on measurements of the product of 1,366 trees of different diameters, actually cut in the woods, as follows: Longleaf Pine, 496 trees; Loblolly Pine, 472 trees; Cuban Pine, 331 trees; Pond Pine, 67 trees. They give the total merchantable volume and the volume of merchantable heartwood and sapwood for diameters from 12 to 36 inches. The volumes given under the several diameters for merchantable heartwood and sapwood represent not the actual volume of heartwood and sapwood, but the volumes of the logs which scaled as heartwood and sapwood logs by the following specifications:

Diameter of logs at small end.	Heart diameter necessary to scale as heartwood logs.	Diameter of logs at small end.	Heart diameter necessary to scale as heartwood logs.
	Inches.		*Inches.*
Not over 12 inches	8	21½ to 24 inches	16
12½ to 15 inches	10	24½ to 27 inches	18
15½ to 18 inches	12	27½ to 30 inches	20
18½ to 21 inches	14	30½ inches and over	22

TABLE 7.—*Merchantable volume by the Two-thirds Rule.*

LONGLEAF PINE.

Diameter breast-high.	Heart-wood.	Sapwood.	Total.	Diameter breast-high.	Heart-wood.	Sapwood.	Total.
Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Inches.*	*Board feet.*	*Board feet.*	*Board feet.*
12	.....	70	70	25	604	.....	604
13	.....	97	97	26	658	.....	658
14	.....	129	129	27	712	.....	712
15	.....	162	162	28	770	.....	770
16	.....	200	200	29	830	.....	830
17	.....	238	238	30	890	.....	890
18	183	97	280	31	958	.....	958
19	233	87	320	32	1,022	.....	1,022
20	305	61	366	33	1,093	.....	1,093
21	410	.....	410	34	1,165	.....	1,165
22	457	.....	457	35	1,240	.....	1,240
23	502	.....	502	36	1,310	.....	1,310
24	552	.....	552				

TABLE 8.—*Merchantable volume by the Two-thirds Rule.*

LOBLOLLY PINE.

Diameter breast-high.	Heart-wood.	Sapwood.	Total.	Diameter breast-high.	Heart-wood.	Sapwood.	Total.
Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Inches.*	*Board feet.*	*Board feet.*	*Board feet.*
12	.....	90	90	25	213	475	688
13	.....	120	120	26	329	421	750
14	.....	150	150	27	445	376	821
15	.....	184	184	28	544	346	890
16	.....	220	220	29	639	322	961
17	.....	259	259	30	729	307	1,036
18	.....	300	300	31	817	297	1,114
19	.....	345	345	32	900	293	1,193
20	.....	394	394	33	985	293	1,278
21	.....	449	449	34	1,070	292	1,362
22	.....	502	502	35	1,160	292	1,452
23	.....	562	562	36	1,250	290	1,540
24	.....	625	625				

TABLE 9.—*Merchantable volume by the Two-thirds Rule.*

CUBAN PINE.

Diameter breast-high.	Heart-wood.	Sapwood.	Total.	Diameter breast-high.	Heart-wood.	Sapwood.	Total.
Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Inches.*	*Board feet.*	*Board feet.*	*Board feet.*
12	.....	50	50	25	410	230	640
13	.....	83	83	26	473	222	695
14	.....	118	118	27	540	215	755
15	.....	155	155	28	617	200	817
16	.....	193	193	29	720	165	885
17	.....	234	234	30	830	125	955
18	.....	276	276	31	945	77	1,022
19	.....	321	321	32	1,095	.....	1,095
20	.....	370	370	33	1,170	.....	1,170
21	152	270	422	34	1,243	.....	1,243
22	221	255	476	35	1,320	.....	1,320
23	288	242	530	36	1,395	.....	1,395
24	350	235	585				

TABLE 10.—*Merchantable volume by the Two-thirds Rule.*

POND PINE.

Diameter breast-high.	Heart-wood.	Sapwood.	Total.	Diameter breast-high.	Heart-wood.	Sapwood.	Total.
Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Inches.*	*Board feet.*	*Board feet.*	*Board feet.*
12	.....	87	87	25	453	151	604
13	.....	112	112	26	520	140	660
14	.....	140	140	27	600	118	718
15	.....	169	169	28	692	86	778
16	.....	200	200	29	797	42	839
17	.....	233	233	30	901	.....	901
18	.....	269	269	31	968	.....	968
19	.....	308	308	32	1,033	.....	1,033
20	.....	349	349	33	1,100	.....	1,100
21	.....	395	395	34	1,170	.....	1,170
22	.....	444	444	35	1,240	.....	1,240
23	.....	497	497	36	1,309	.....	1,309
24	.....	548	548				

The volume tables used for scaling Cypress and hardwoods were constructed in connection with the preparation of a working plan for another tract, where the conditions were similar to those on the lands of the Okeetee Gun Club.

LUMBERING.

The majority of the holdings purchased by the Okeetee Gun Club had been lumbered by their former owners. It is difficult to give the dates for the lumbering on different portions of the tract. Methods have been largely determined by the nature of the mills to supply which the lumbering was done. There has never been a mill on these lands equipped for thorough utilization of all timber; the work has all been done by circular-saw mills of small capacity, in the desultory manner characteristic of the older lumbering throughout the South.

After the purchase of the tract the club lumbered in a small way for three years. The operations differed in no essential respect from the earlier logging. It was discontinued because of the unsatisfactory condition in which the lands were left, and because of the unnecessary waste incident to the methods employed. Timbers of large size were sawed to order. Logging to fill special orders resulted in the waste of much valuable material in tops and butts, and in the leaving of standing and felled trees. (Pl. VII.) The trees most desired by the lumbermen were those of medium size. Large mills saw to order, but with orders for many different sizes of timber constantly on hand it is possible for them so to systematize the logging that the method does not interfere with a clean job. For a small mill, handling a comparatively small number of orders, it is utterly impossible to log cleanly and at the same time economically. With absurdly inadequate facilities for transportation and milling, these small mills were practically limited to the finest logs, from which the best grades of dimension timber could be manufactured. Unequipped to handle the inferior grades of lumber, they wasted more timber than they used. The local mill men send all their product to the Savannah market. There would be a considerable percentage of the timber which this market would not absorb, even if the mills themselves were equipped to handle it. The club would experience no difficulty in disposing of its remaining timber to local mill men, but they would merely cull out the best timber, leaving the rest on the ground or in the slab piles at the mill.

TURPENTINING.

Turpentine orcharding has been the indirect cause of the total destruction of large bodies of pine forest on the lands now owned by the Okeetee Gun Club. A very large part of the Longleaf and Cuban Pine on the tract has been boxed at one time or another. Most of the boxing was done before the club acquired the land.

The production of naval stores from this forest has been nearly as important as the lumber industry itself. Its development has been out of proportion to the development of lumbering. Turpentine orcharding, as compared with lumbering, requires small capital and equipment. Transportation of crude turpentine is simple and inexpensive, and the work of orcharding is liked and well understood by the people. While the timber had as yet practically no stumpage value, turpentine stills went up everywhere, and forests entirely inaccessible for their timber could be profitably worked for turpentine. Turpentine boxing, therefore, went far in advance of lumbering, and the future value of the timber was often entirely destroyed for the sake of a small immediate gain. Later it became the rule to tap for turpentine only when the forest was to be lumbered immediately after the turpentine orcharding. As a matter of fact, however, lumbering can immediately follow turpentine boxing only in theory, for turpentine operations usually extend over a territory so large that lumbering follows in many cases only after a number of years.

It is the writer's observation, supported by the opinion of many lumbermen who have had years of experience in logging abandoned turpentine orchards, that the financial loss due to damage by fire, windfall, and insects in boxed forests often more than counterbalances the gain from turpentine boxing. This opinion has become general only in late years, since the rise in the value of southern pine timber. The virgin Longleaf Pine forests remaining are not generally being worked for turpentine. It is left for the already deteriorated forests of the eastern part of the pine belt to supply the demand for naval stores, which in consequence are now largely derived from the second-growth pine. While a few years ago only large trees were boxed, it is now not uncommon to box trees 6 inches in diameter.

Since as a rule the pine is cut only to about 14 inches for lumber, the enormous waste in boxing young trees is evident. The fact that they may be cut for railroad ties does not solve the problem, since the value of small pine for ties is entirely out of proportion to their potential timber value.

Boxing is injurious to the forest in many ways. The smaller trees are blown down by the wind almost at once. (Pl. IX, fig. 1.) The old trees are weakened year by year at the base by inevitable fires, which burn in the old boxes so that eventually the tree falls from the combined effect of fire and wind. The fires prevent the healing over of the scarified faces in trees which remain standing, and their vitality is so greatly reduced that a large percentage die. Examination of the old boxes showed that boxed trees are commonly attacked by insects after fire has dried the face of the box, and that the base of the tree is frequently decayed. By the gradual fall of boxed trees a mass of fuel collects on the ground which makes fires much more destructive, and

prolongs indefinitely the period of danger from this source. (Pl. IX, fig. 2.)

One purchase, known as the English tract, was a large body of virgin and second-growth Longleaf and Cuban Pine which had not been boxed when the club acquired the land. A considerable amount of the best timber was blown down by a storm in 1898. The club desired to undertake lumbering mainly in order to save this down timber. As a preliminary to lumbering it determined to carry on turpentining for a period of three years. Sixteen crops were accordingly boxed in the best timber, on an area of 4,769 acres, shown by Block 1 on the map (Pl. XIII). The boxing proved a grave mistake. The forest was largely composed of young trees, which, under conservative management, would have produced valuable crops of timber for an indefinite period. The difficulties of management are greatly increased by the necessity of cutting out the unmarketable boxed trees, the loss of which makes serious inroads on the basis for future crops.

FIRE.

EFFECTS.

The injurious effects of the fires which have run over the tract for many years are everywhere at hand. The pine lands are burned over almost annually. The harm done varies with the kind of fire, the character and condition of the forest, the size of the trees, and the time of year when the fire occurs.

Most of the fires are grass fires. They burn off the growth of grass and sedge which comes up thickly in the fields and open pine forests, and with it destroy the seedling pines. In swamps and on swampy flats, where the forest is too dense to allow of a growth of grass, brush fires are fed by the undergrowth and litter. On pine lands humus is either very thin or is lacking entirely; destructive humus fires, common in some forest regions, are here unknown. Crown fires, or fires which burn in the tops of the trees, have not yet occurred in this forest.

Cypress gum swamp burns only in exceptionally dry seasons; but the luxuriant undergrowth accumulates a large quantity of inflammable material, so that when a fire does penetrate a swamp it is severe. The injury is chiefly to the Cypress and the young hardwoods. The thin bark of the Cypress offers a poor protection against fire; this to some extent accounts for its frequent unsoundness. In the dense forests on the moister pine lands, where the hardwoods, especially Oak, enter into the mixture, conditions are much the same as in the swamps. Fires are rare, but they are apt to be destructive on account of the thick undergrowth.

CUBAN PINE BOXED FOR TURPENTINE.

FIG. 1.—SMALL LONGLEAF PINE BOXED FOR TURPENTINE AND BLOWN DOWN BY WIND.

FIG. 2.—ABANDONED TURPENTINE ORCHARD. DESTRUCTION WHICH FOLLOWS BOXING; RESULT OF FIRE AND WIND.

Standing pine is seldom destroyed by fire after the sapling stage, except when the trees have been boxed for turpentine, or after lumbering. Boxing immensely increases the danger and damage from fire. The total destruction of an abandoned turpentine orchard requires only a few years. But the most destructive fires have followed lumbering, owing to the great amount of inflammable material left on the ground.

Although ordinary fires do not kill good-sized trees outright, they often scorch severely enough to check growth or result in unsoundness at maturity. But the greatest damage from fires is the annual destruction of large numbers of seedlings. Successful reproduction of pine results only where there is protection from fire. With the present lack of precaution against fires, protection is very limited and purely accidental. It is the result of obstacles to the spread of ground fires. A slight elevation will often escape for a number of years. A swamp hole or road will check the progress of a fire; a sheltered area is left to leeward, where the fire, eating back from the sides against the wind, dies out. Logs and stumps often have the same effect on a smaller scale. (Pl. X.)

Small areas frequently escape burning because of a difference in the character of the ground cover. They occur where the soil is dry sand. The wire grass found here is a thinner growth than the surrounding broom sedge, and does not become thoroughly dry until later in the season. A ground fire which burns hotly in the broom sedge often burns around an area of wire grass. It is on these areas that much of the recent reproduction of Longleaf Pine has taken place.

Without doubt fire has had much to do with the fact that Longleaf Pine seedlings greatly predominate on the tract, in spite of the greater number of seed trees of the other pines and the greater frequency of their seed years. The Longleaf seedling, with its thick mantle of long needles enfolding the bud and shading the ground, is much better protected against fire than the shorter-leaved, thinner-crowned seedlings of the other pines. The ability of the Longleaf Pine to reproduce itself in spite of the greatest disadvantages is well illustrated on this tract, which, however, gives no idea of what the tree can do with adequate protection. The Longleaf Pine may rightly be called a fireproof species in so far as the survival of scattered groups and patches of second growth and individuals is concerned. But extended areas under forest are impossible under present conditions.

It is on account of just this fireproof quality of the Longleaf Pine that the injury which results from fire in the deterioration of the forest soil is the more easily overlooked. There is at present scarcely a trace of a soil cover of humus anywhere on the pine lands. A humus layer stores moisture and holds food material for the trees, and is vital to the well-being of the forest; the absence of it tends toward

the production of open forests of short-boled, long-crowned trees, which yield poor timber. This result is less noticeable in the case of the Longleaf Pine than in that of the other pines on the tract, because of the greater power of the Longleaf to clear itself of its lower branches when growing in an open stand.

The only damage from fire which is heeded is that to large timber. There is a complete disregard or ignorance of the capacity of lumbered lands which are protected from fire to produce a second crop. It is not so much the damage to the standing trees, either large or small, that makes the question of fire protection vital to the future value of the forest, as the absolute impossibility of satisfactory reproduction if frequent ground fires are allowed. Conservative management of these lands, cut over as well as timbered, can be successful only with protection from fire.

CAUSES.

The most potent cause of fire on the tract of the Okeetee Gun Club is the lack of sentiment against fire among the native population, coupled with the great contempt for property rights. Fires are carelessly set to improve grazing, to clear land, and to protect woods where turpentine is being gathered, with entire disregard of the likelihood that they will spread to other areas. Many are also due to malice; and for many more the railroads are responsible.

PREVENTION.

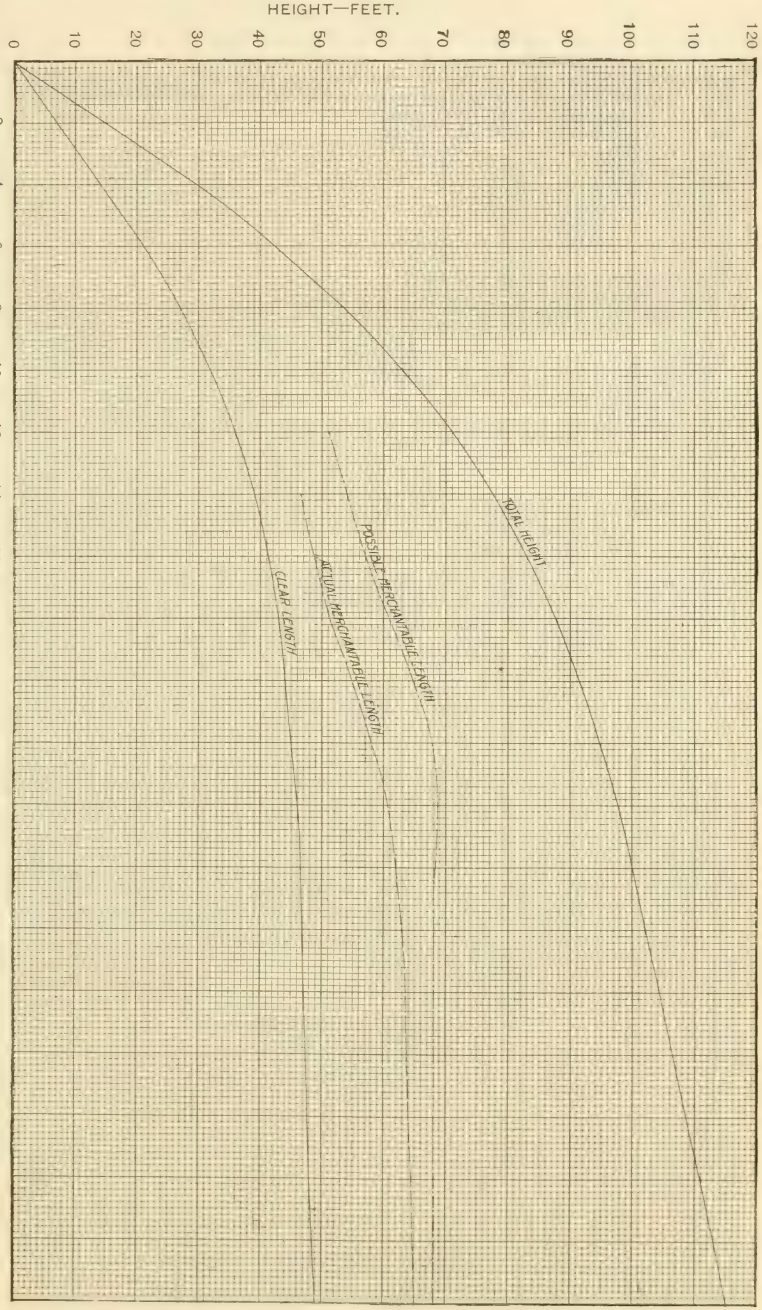
Under existing conditions complete fire protection on these lands would be exceedingly difficult, and the cost would be prohibitive. Ultimate success depends upon the possibility of overcoming the ignorance and prejudice of the native population. The people must be educated to a sentiment against fires. A system of patrol which will afford partial protection from fire is recommended in this working plan (p. 47). It is believed that it can be made to limit the destruction of standing timber, and to insure the return of the forest to much land now devastated.

THE FOREST TREES.

LONGLEAF PINE.

On these lands the Longleaf Pine seldom occurs in swampy or poorly drained situations. It formerly occupied all the highest and driest portions of the tract, in unbroken pure forest covering wide areas. Drainage is the factor which chiefly determines its distribution. It will grow on soils too dry for any other species, and becomes a valuable timber tree where the other pines remain stunted. The best timber is found where the subsoil contains considerable clay, but is porous enough to allow easy drainage.

A small amount of Longleaf Pine seed is produced every year, but full masts occur only at long intervals. The seed falls during late



LONGLEAF PINE.

DIAGRAM 1.—Total height, clear length, actual and possible merchantable length on a basis of diameter breasthigh.

autumn and winter. Seedlings start up the following spring, but they are usually killed by fire, either immediately or later in the year.

If the reproduction of Longleaf Pine is unsuccessful on dry pine land, no other species comes up, and the only soil cover is a growth of grass and sedge. Wire grass marks the drier situations, broom sedge

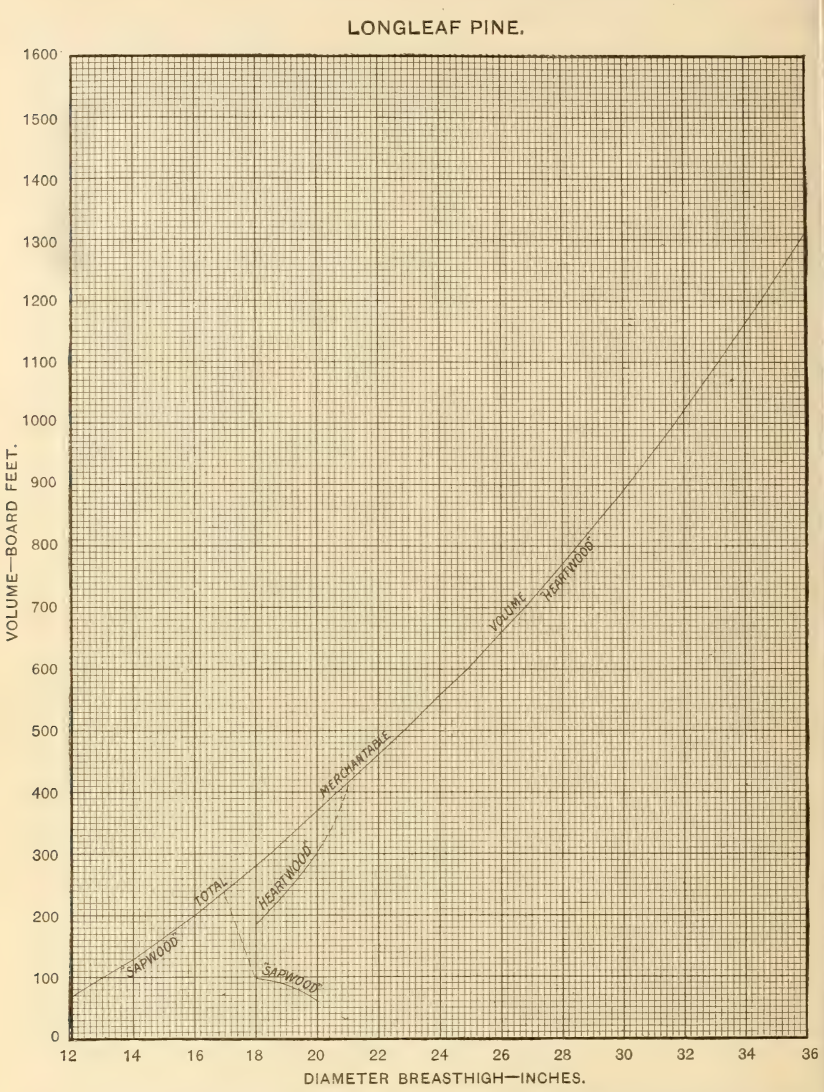


DIAGRAM 2.—Total merchantable volume and volume of merchantable heartwood and sapwood, in board feet by the Two-thirds Rule, on a basis of diameter breasthigh.

the moister soil. Scrub Oak very rarely follows the removal of the pine, as it does in many other parts of the Southern pine belt.

Longleaf Pine bears very little shade; it must have direct overhead sunlight. There is no reproduction in the shade of the old forest.

Reproduction in virgin forest is confined entirely to windfall or other openings where the breaking of the forest cover admits the direct rays of the sun. The requirement of this species for full light is further shown by the rapid thinning out of the overtopped trees during all stages in the growth of the forest. For the same reason it does not form dense woods.

The Longleaf Pine develops a long tap root and a short, open crown. It has the power of clearing its trunk of the lower branches, and produces clear timber even when grown in the open.

LOBLOLLY PINE.

There is much confusion in the names used locally to designate the Loblolly Pine. The species is not known by the name Loblolly Pine, but is commonly called Black Pine. It is also often called Shortleaf. Under these names is included also the Pond Pine, which is rarely distinguished as a distinct tree. On the other hand, the best timber trees of Loblolly Pine, which occur in and near the swamps, are often called Swamp Pine, while the dilapidated growth on land formerly tilled generally receives the name of Old-field Pine, or Sap Pine.

The Loblolly Pine occurred originally in and along the margins of swamps in small groups, or scattered by single trees on better-drained portions and on hummocks. The indications are that it spread from here to the moister Longleaf Pine lands. Its spread was much aided by the early clearing for field crops. There are extensive woods of second-growth Loblolly Pine on lands which were once tilled, as may easily be seen from the old furrows. This encroachment is still going on. Germination of the seed is favored by the turning of the soil, which is also an effective protection against ground fires through the turning under of the grass. Thus aided, the Loblolly Pine has seeded up fields on Longleaf Pine land which are too dry for the successful later development of the tree. The result is open stands of small, short-boled, defective trees, full of limbs and knots, which yield low-grade logs. Except for this second growth on old fields, Loblolly Pine never reseeds dry sands. It reaches its best development where moisture is not excessive, but constant and evenly distributed throughout the growing season.

Unlike the Longleaf Pine, the Loblolly produces seeds in abundance almost every year. It begins to bear seed at an early age; cones are sometimes seen on trees not more than 1 inch in diameter. The great majority of seedlings perish in the ground fires.

The seedlings withstand a considerable amount of shade. They are often abundant on knolls in the swamps, where the dense cover of the swamp forest is but slightly broken. The growth is much faster, however, where access is given to direct sunlight.

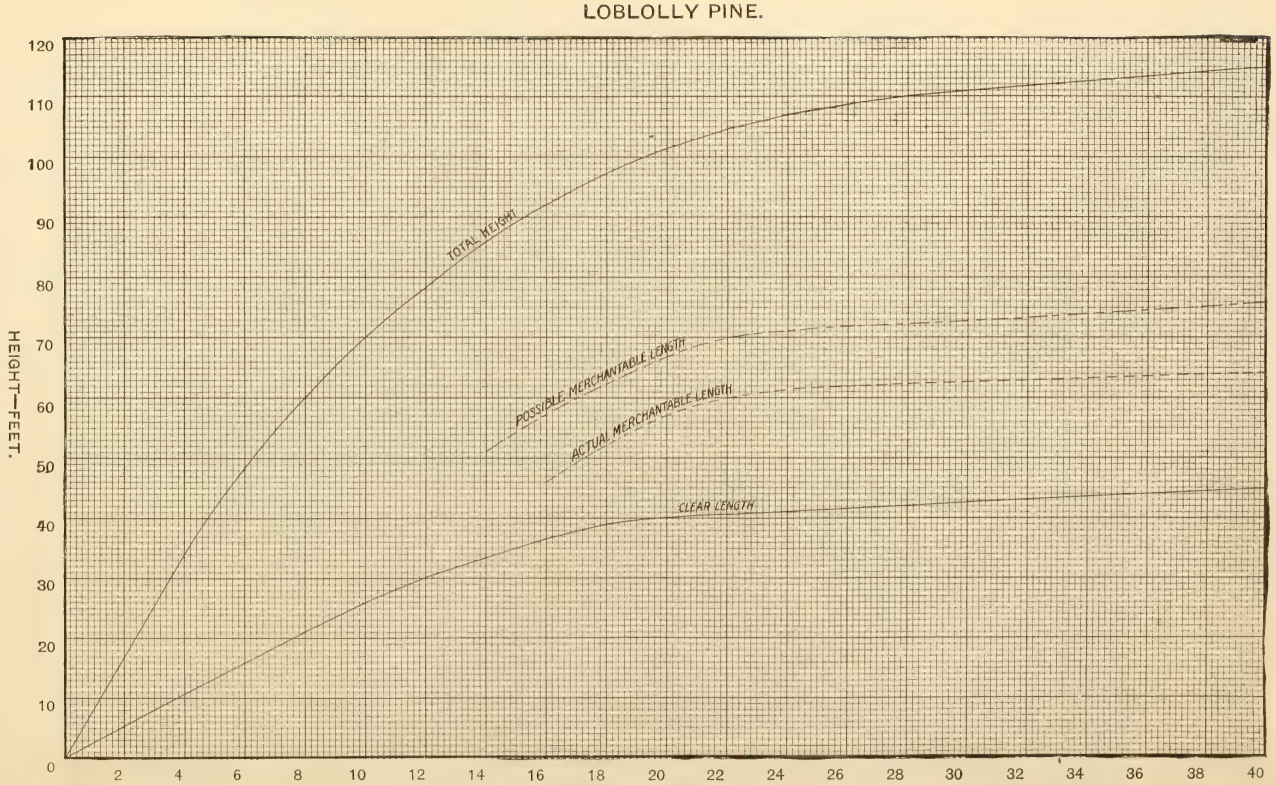


DIAGRAM 3.—Total height, clear length, actual and possible merchantable length on a basis of diameter breasthigh.

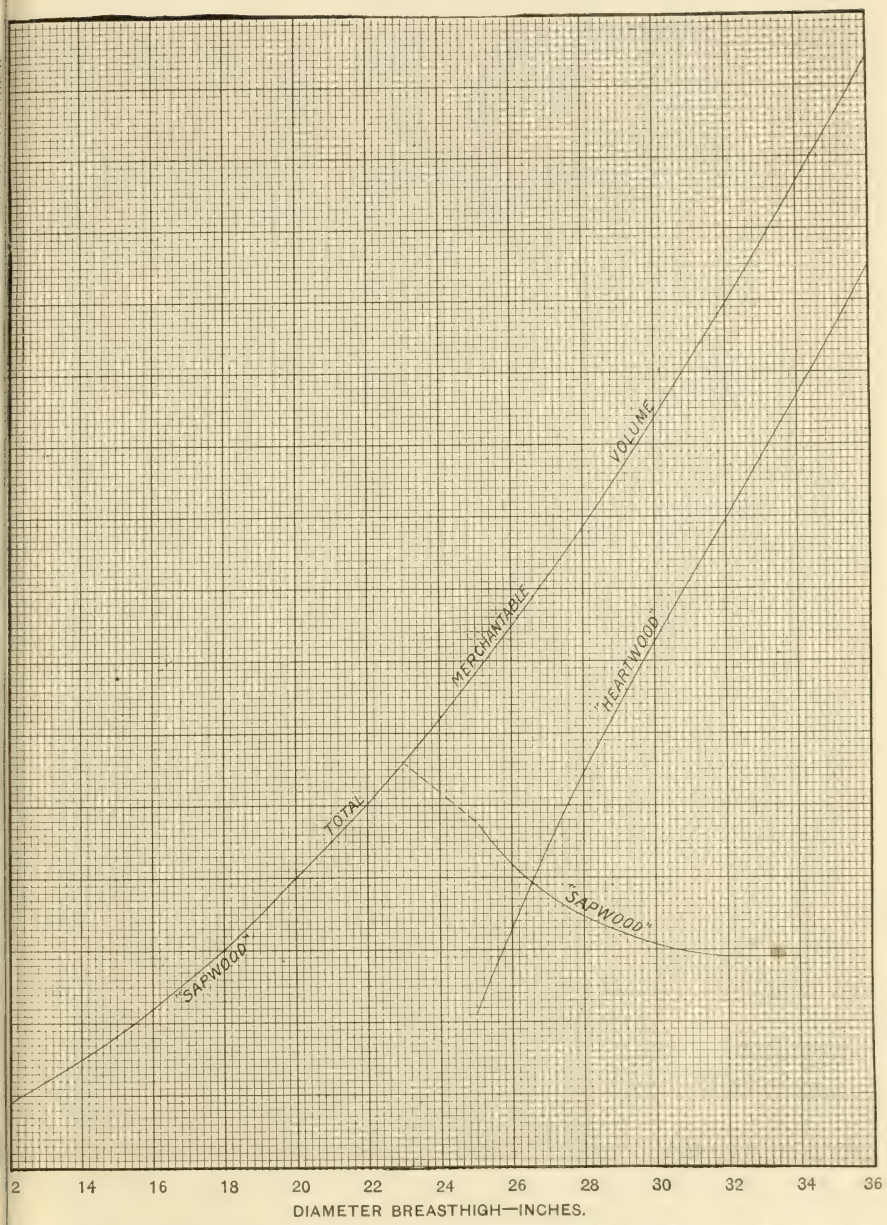


DIAGRAM 4.—Total merchantable volume and volume of merchantable heartwood and sapwood, in board feet by the Two-thirds Rule, on a basis of diameter breasthigh.

The Loblolly Pine, unlike the Longleaf, which sends long roots deep down in search of moisture, develops a flat root system. This largely explains its inability to follow the Longleaf on dry sands which overlie a clay subsoil.

The crown of the Loblolly Pine in dense forest is small, and the stem is long and clear; in open stands, however, the stem is short and the crown full. A dense stand is necessary for the production of clear timber. The ill-founded prejudice against second-growth Loblolly Pine as a timber tree is partly explained by the worthless groves which have resulted from the too scattered seeding up of old fields. There are plenty of dense stands of second-growth Loblolly Pine on the tract of the Okeetee Gun Club which promise valuable timber.

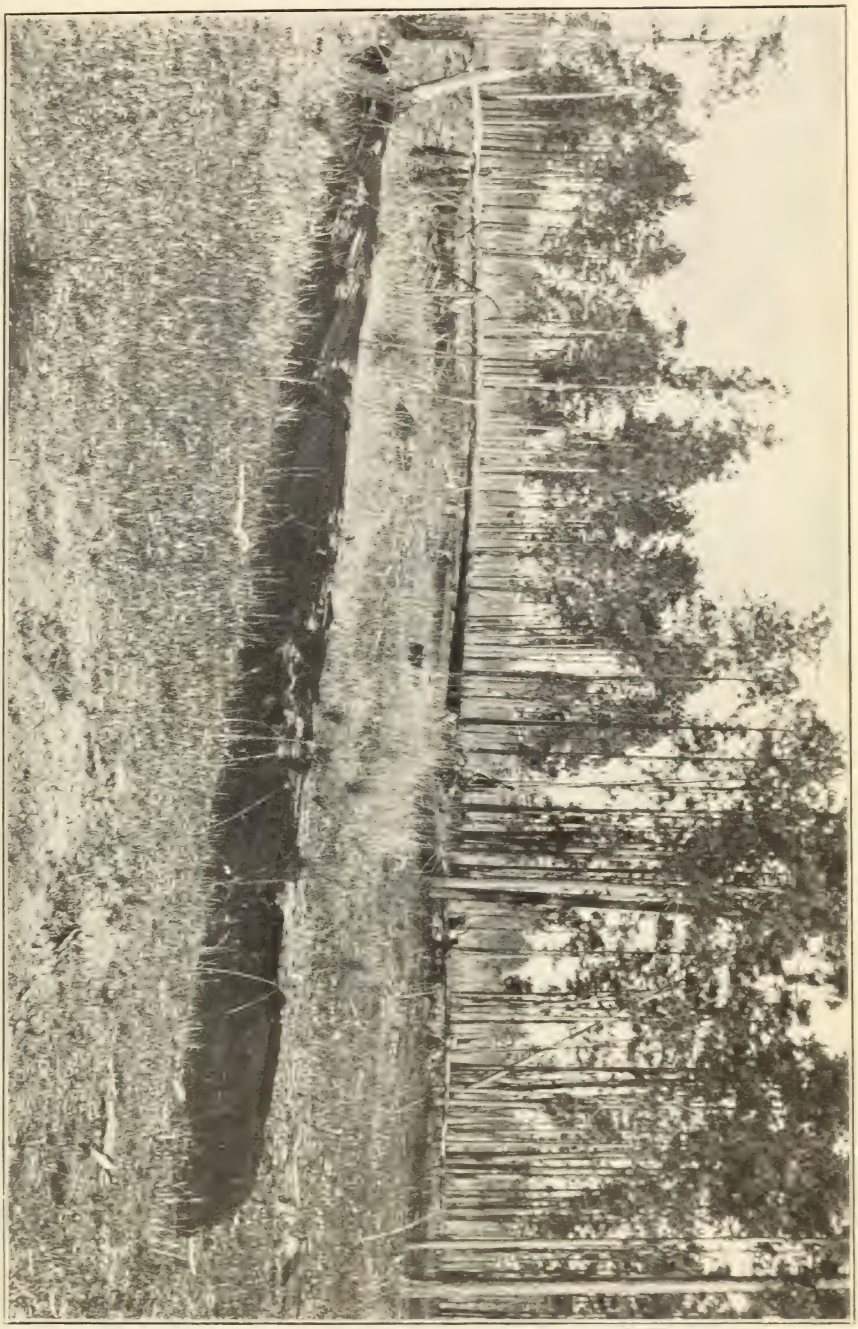
CUBAN PINE.

The Cuban Pine is locally known as 'Slash' or 'Yellow Slash' Pine. When fully grown it reaches the dimensions of the Longleaf. The largest tree found on the lands of the Okeetee Gun Club had a breasthigh diameter of 35 inches and a height of 112 feet. When mature the quality of the timber rivals that of the Longleaf Pine, and it is lumbered and sold indiscriminately with the latter.

Like the Loblolly Pine, the Cuban Pine requires a constant and even supply of soil moisture throughout the growing season. It withstands an excess of moisture to a greater degree than the Loblolly. It is found in groups and narrow belts bordering the swamps, where it contends with Loblolly Pine for possession. Scattered by single trees, it enters far into the swamps. In mixture with Longleaf Pine it occurs in small groups occupying depressions and moist spots.

In regularity and abundance of seed crops the Cuban Pine surpasses the other pines on this tract. Under favorable conditions the germination of its seed is satisfactory, but it is greatly hindered by the rank growth of broom sedge in the moist situations especially suited to its growth. Fire largely prevents reproduction. That otherwise reproduction would be successful is shown by the dense thickets of second growth on small areas which have been exempt from fire for several successive seasons.

In its demands upon light the Cuban Pine stands between the Longleaf and the Loblolly. During the seedling stage it bears considerable shade, but the growth of young trees is much more rapid where direct light reaches them. The root system is superficial. In its power to clear its trunk of branches in open stand it approaches the Longleaf Pine. In dense forest the Cuban Pine produces a long, clean stem and a short, thick crown.



SEEDLINGS OF LONGLEAF PINE PROTECTED FROM FIRE BY A FALLEN LOG (FOREGROUND).

FIG. 1.—INFERIOR SECOND GROWTH OF LOBLOLLY PINE ON ABANDONED FIELDS, KNOWN LOCALLY AS OLD-FIELD PINE.

FIG. 2.—SECTION OF LOBLOLLY PINE.
Wide rings show rapid growth in diameter

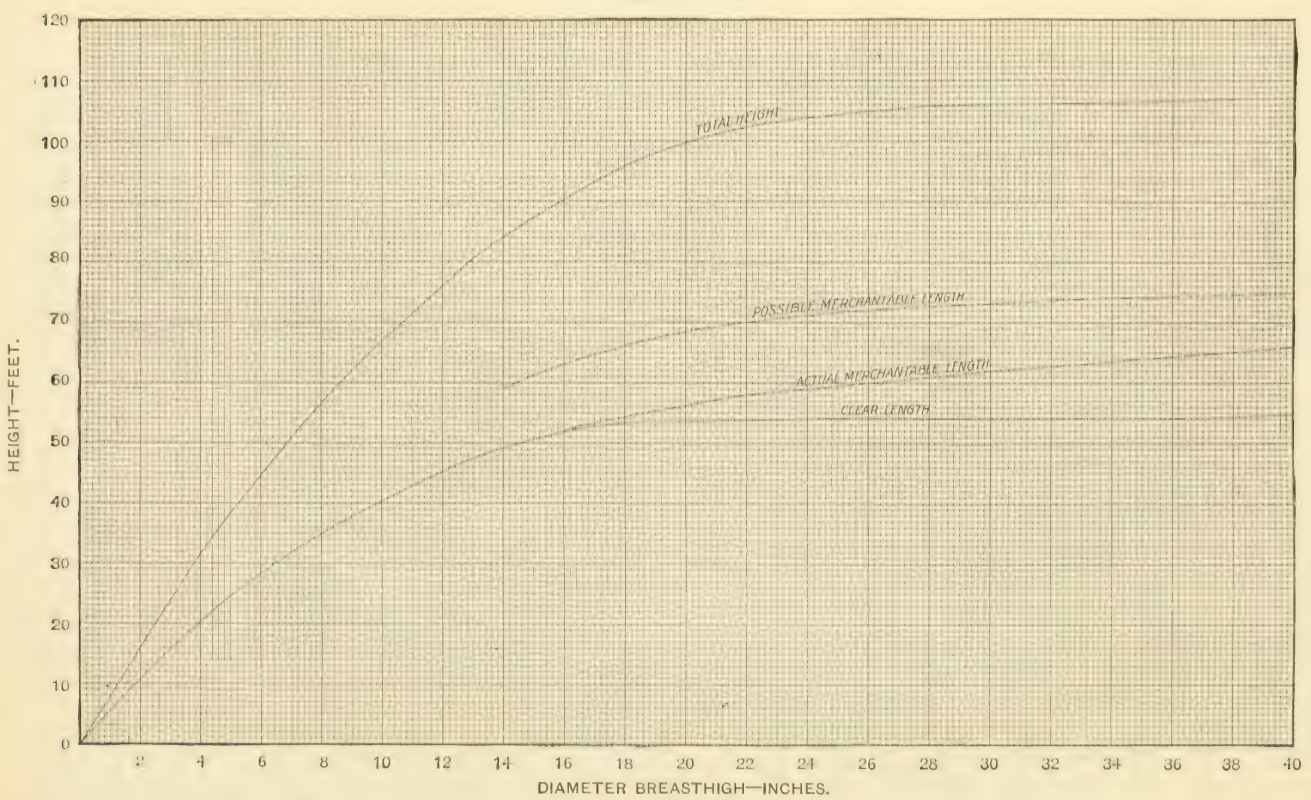


DIAGRAM 5.—Total height, clear length, actual and possible merchantable length on a basis of diameter breasthigh.

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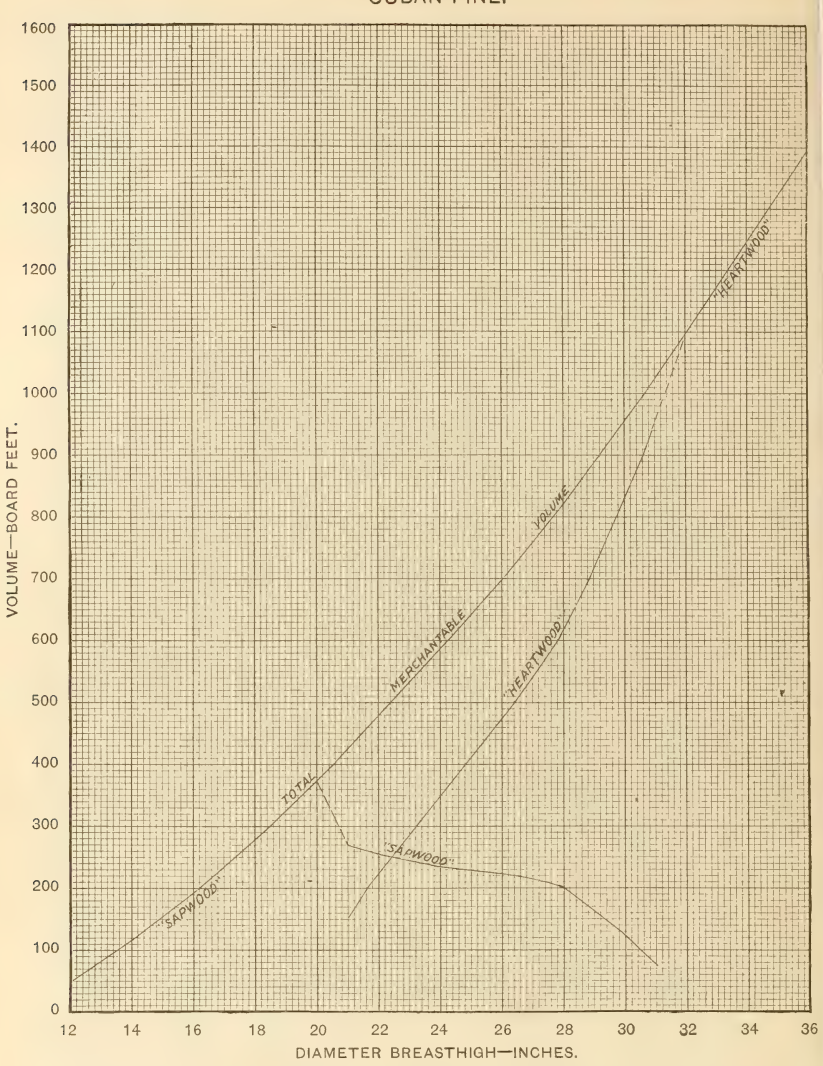


DIAGRAM 6.—Total merchantable volume and volume of merchantable heartwood and sapwood, in board feet by the Two-thirds Rule, on a basis of diameter breasthigh.

POND PINE.

The Pond Pine is not a large tree on the tract of the Okeetee Gun Club, and its commercial value is less than that of any of the other pines common there. Old, slow-grown trees produce good timber, but that of rapidly grown young trees, of which much of the stand of Pond Pine consists, is inferior in quality.

Pond Pine forms pure forest to a less extent than any of the other pines. It occurs by single trees and in small groups on the interme-

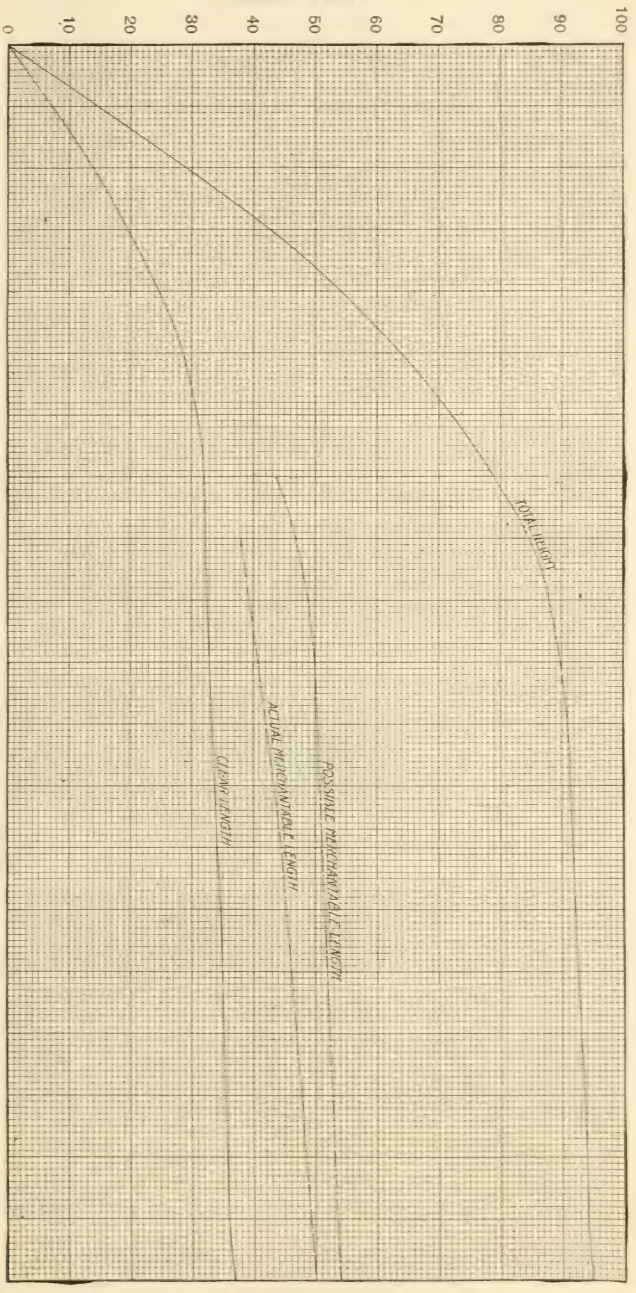


DIAGRAM 7.—Total height, clear length, actual and possible merchantable length on a basis of diameter breasthigh.

diate type of moist pine land, more frequently in mixture with Cuban Pine than with Loblolly; it is also found on the fresher Longleaf Pine

lands. It grows on poor soils and on excessively moist soil, but avoids swamps.

Full crops of cones are so characteristic of the Pond Pine as to be a means of distinguishing this species from the Loblolly Pine, which it

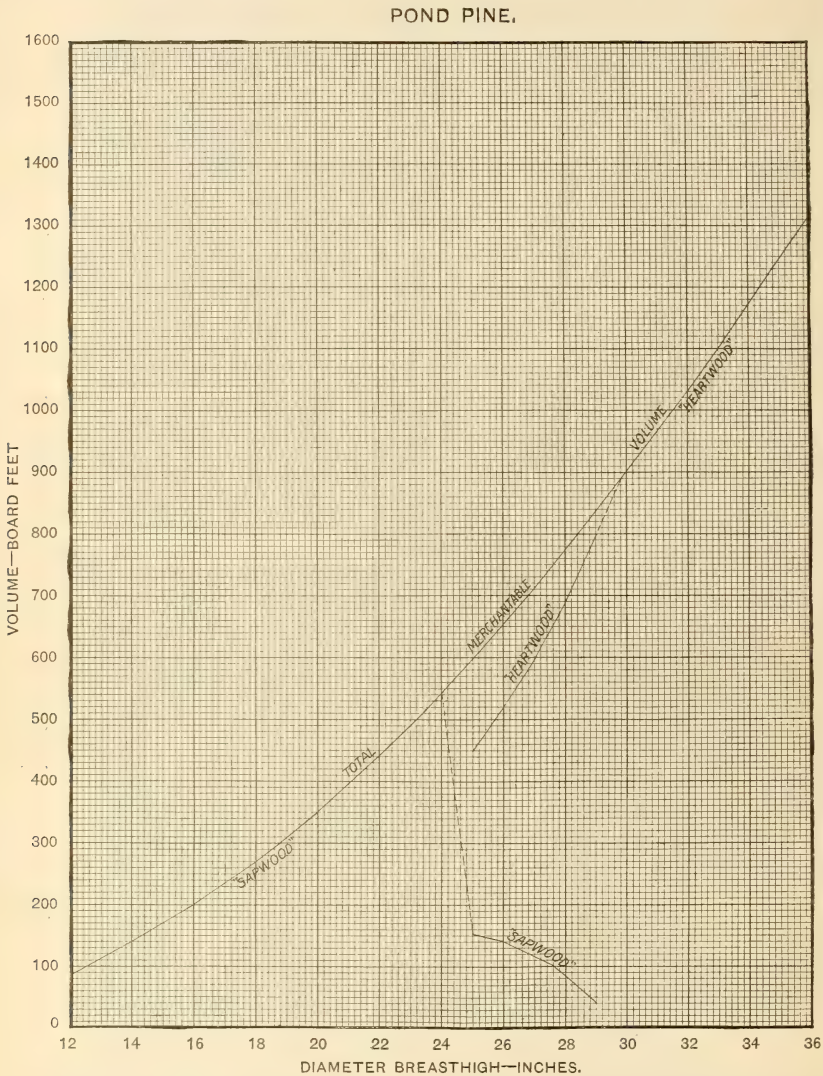


DIAGRAM 8.—Total merchantable volume and volume of merchantable heartwood and sapwood, in board feet by the Two-thirds Rule, on a basis of diameter breasthigh.

closely resembles; but the cones are persistent, and very commonly remain on the tree for several seasons without opening, so that it does not seed so abundantly as the Cuban and Loblolly pines.

This species sprouts freely from the stump. It is probable that much of the young growth is of sprout origin. Seedlings of Pond Pine bear partial shade, though not so much as Loblolly Pine. Pond Pine is gaining ground in the reproduction. Much of this second growth is of the unpromising 'Old-field,' open-stand variety.

The root system is superficial. In the open the tree develops many small branches, and the crown is long. Sprout-like branches often grow along the entire trunk.

SPRUCE PINE AND SHORTLEAF PINE.

Spruce Pine (*Pinus glabra* Walt.) and Shortleaf Pine (*Pinus echinata* Mill.) occur on these lands, but in small numbers. Spruce Pine is confined to the swamps; Shortleaf is found only in the second growth on Longleaf Pine land.

The following tables show the development of Longleaf, Cuban, Loblolly, and Pond Pine in total height, clear length, and actual and possible merchantable length on a basis of diameter at breastheight (4½ feet from the ground). Diagrams 1, 3, 5, and 7 are graphic representations of these tables for each species separately.

TABLE 11.—*Total height on a basis of diameter breasthigh.*

Diameter breast-high.	Pond Pine.	Long-leaf Pine.	Cuban Pine.	Loblolly Pine.	Diameter breast-high.	Pond Pine.	Long-leaf Pine.	Cuban Pine.	Loblolly Pine.
Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Inches.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
4	29	30	32	34	18	88	87	95	98
5	36	37	39	42	19	89	89	97	100
6	42	43	45	48	20	90	91	99	102
7	48	48	51	54	21	91	93	101	104
8	54	53	57	60	22	91	95	102	105
9	59	58	62	65	23	91	96	103	106
10	64	63	67	70	24	91	97	104	107
11	68	67	72	75	25	92	98	104	108
12	72	71	76	79	26	92	99	105	108
13	76	74	80	83	27	92	100	105	109
14	79	77	84	86	28	92	101	106	110
15	82	80	87	89	29	92	102	106	110
16	85	83	90	92	30	93	103	106	111
17	87	85	93	95					

TABLE 12.—*Clear length on a basis of diameter breasthigh.*

Diameter breast-high.	Pond Pine.	Loblolly Pine.	Long-leaf Pine.	Cuban Pine.	Diameter breast-high.	Pond Pine.	Loblolly Pine.	Long-leaf Pine.	Cuban Pine.
Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Inches.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
4	14	11	15	21	18	33	38	43	53
5	17	14	18	25	19	33	39	44	53
6	20	17	21	29	20	33	40	44	54
7	23	20	24	32	21	33	40	45	54
8	25	22	27	35	22	33	40	45	54
9	27	24	30	38	23	34	41	46	54
10	29	26	33	41	24	34	41	46	54
11	30	28	35	44	25	34	41	46	54
12	31	30	37	46	26	34	41	46	54
13	32	32	38	48	27	34	42	47	54
14	32	34	39	50	28	35	42	47	54
15	32	35	40	51	29	35	42	47	54
16	32	36	41	52	30	35	43	47	54
17	33	37	42	53					

TABLE 13.—*Actual merchantable length on a basis of diameter breasthigh.*

Diameter breast-high.	Pond Pine.	Loblolly Pine.	Cuban Pine.	Long-leaf Pine.	Diameter breast-high.	Pond Pine.	Loblolly Pine.	Cuban Pine.	Long-leaf Pine.
Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Inches.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
15	.....	.....	.....	48	23	43	61	59	60
16	37	46	52	48	24	44	61	59	61
17	38	49	53	49	25	44	62	60	61
18	39	52	54	51	26	45	62	60	62
19	40	55	55	53	27	45	62	61	62
20	41	57	56	55	28	45	62	61	63
21	42	58	57	57	29	46	62	62	63
22	43	60	58	59	30	46	62	62	63

TABLE 14.—*Possible merchantable length on a basis of diameter breasthigh.*

Diameter breast-high.	Pond Pine.	Long-leaf Pine.	Loblolly Pine.	Cuban Pine.	Diameter breast-high.	Pond Pine.	Long-leaf Pine.	Loblolly Pine.	Cuban Pine.
Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Inches.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
12	.....	51	.....	.....	22	51	67	70	70
13	.....	53	.....	.....	23	51	68	71	70
14	44	54	51	59	24	51	68	71	71
15	46	55	54	61	25	51	68	72	72
16	47	57	57	63	26	51	68	72	72
17	48	58	60	65	27	51	68	72	72
18	49	60	62	66	28	52	68	72	72
19	50	62	65	67	29	52	68	72	72
20	50	64	67	68	30	52	68	73	73
21	50	66	68	69					

The average increase in height for each diameter class does not vary greatly for the different pines. At first rapid, it falls off regularly as the diameter increases. The average increase for Longleaf Pine under 5 inches in diameter is a little over 7 feet. It then gradually falls off; at a diameter of 13 inches it is but 3 feet, and at 23 inches it has fallen to 1 foot.

Clear length is the distance from the ground to the first large branch or large visible knot forming a serious timber defect. For all the pines the average increase in clear length equals approximately one-half the average increase in total height for the lower diameters, but is inconsiderable after they have reached a diameter of 14 to 16 inches. A Longleaf Pine 14 inches in diameter has more than four-fifths of the clear length of the largest trees. By the time the tree is 20 inches in diameter it has almost reached the maximum clear length.

The actual merchantable length is the length of merchantable logs actually cut. The possible merchantable length is the length of logs which under identical conditions of market and transportation might have been cut had there been less waste in sawing. The waste is due to failure to vary the length of logs so as to include all of the tree which is not too rough to make timber under the required specifications, and also to carelessness in cutting logs longer than is necessary for the required log lengths. Three or 4 inches on the length of each log is allowed in order to insure full-length boards after sawing at the mill; but the allowance is permitted from carelessness greatly to exceed this amount, with the result that what would otherwise have made another log is often left in the top.

The proportion of merchantable length, either actual or possible, to the total height does not follow the proportion of clear length to total height. It is much smaller for small trees, and increases much more rapidly as the tree grows. Longleaf Pine 12 inches in diameter will not average two 12-foot logs cutting to a top diameter of 8 inches. In this locality trees smaller than 14 to 15 inches in diameter at breast-height are not often logged. A 15-inch tree yields on the average three 12-foot logs. In practice, however, only one, or at most two, logs are taken. At this diameter the merchantable length is increasing rapidly. This continues until the tree reaches a diameter of 22 inches, after which the increase in merchantable length is slight.

MERCHANTABLE VOLUME ON A BASIS OF DIAMETER BREASTHIGH.

Tables showing the total merchantable volume and the volume of merchantable heartwood and sapwood of Longleaf, Loblolly, Cuban, and Pond Pine for diameters from 12 to 36 inches are given on pages 20 and 21. Diagrams 2, 4, 6, and 8 are graphic representations of these tables.

The total merchantable volume for the same diameter does not vary greatly for the different pines. Loblolly has a slightly greater volume at a given diameter than any of the other pines, and Longleaf Pine has generally the least.

As explained on page 20, the volumes given for merchantable heartwood and sapwood are not the actual volumes of heartwood and sapwood, but the volumes which the logs scale under the specifications for heartwood and sapwood logs. Consequently the curves in the diagrams showing the development in volume of sapwood and heartwood do not progress evenly. The curve for sapwood falls abruptly when the tree has reached a diameter such that the butt log has 8 inches of heart diameter at the small end and the tree no longer scales as all sapwood; similarly the curve for heartwood rises abruptly when all the logs begin to scale as heartwood.

The measurements upon which the tables and curves for Pond Pine are based were necessarily made upon such trees as were being cut by the lumbermen. As only the best trees were logged, the tables and diagrams represent a development considerably above the average of the species.

The following table and diagram (9) show the height in feet of Longleaf, Cuban, and Loblolly Pine for successive 10-year periods from 10 to 240 years:

TABLE 15.—*Height on a basis of age.*

Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.	Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.
Years.	*Feet.*	*Feet.*	*Feet.*	*Years.*	*Feet.*	*Feet.*	*Feet.*
10	6	14	19	130	82	100	108
20	19	29	44	140	84	101	108
30	30	44	65	150	86	102	109
40	40	57	79	160	87	103	109
50	48	67	89	170	89	103	110
60	55	75	95	180	90	104	110
70	60	81	99	190	91	104	111
80	65	86	102	200	92	105	111
90	70	90	104	210	93	105	111
100	73	93	105	220	94	105	112
110	77	96	106	230	95	106	112
120	79	98	107	240	96	106	112

The rate of height growth of Longleaf Pine shows wide variation. Under unfavorable conditions the seedling stage is prolonged, the young trees requiring as much as eight or ten years to reach a height of 1 foot. On plowed land and on good soil the growth is rapid from the start. Fire greatly retards the growth. Under average conditions the maximum height growth of the tree is between the tenth and twentieth years—15 to 16 inches annually. By the fiftieth year it has fallen to 9½ inches; by the hundredth year, to 3½ inches. The mean

TWO-STORIED FOREST OF LONGLEAF AND CUBAN PINE.

The forest management advised aims to produce a similar forest on all pine lands by stimulating reproduction and protecting second growth.

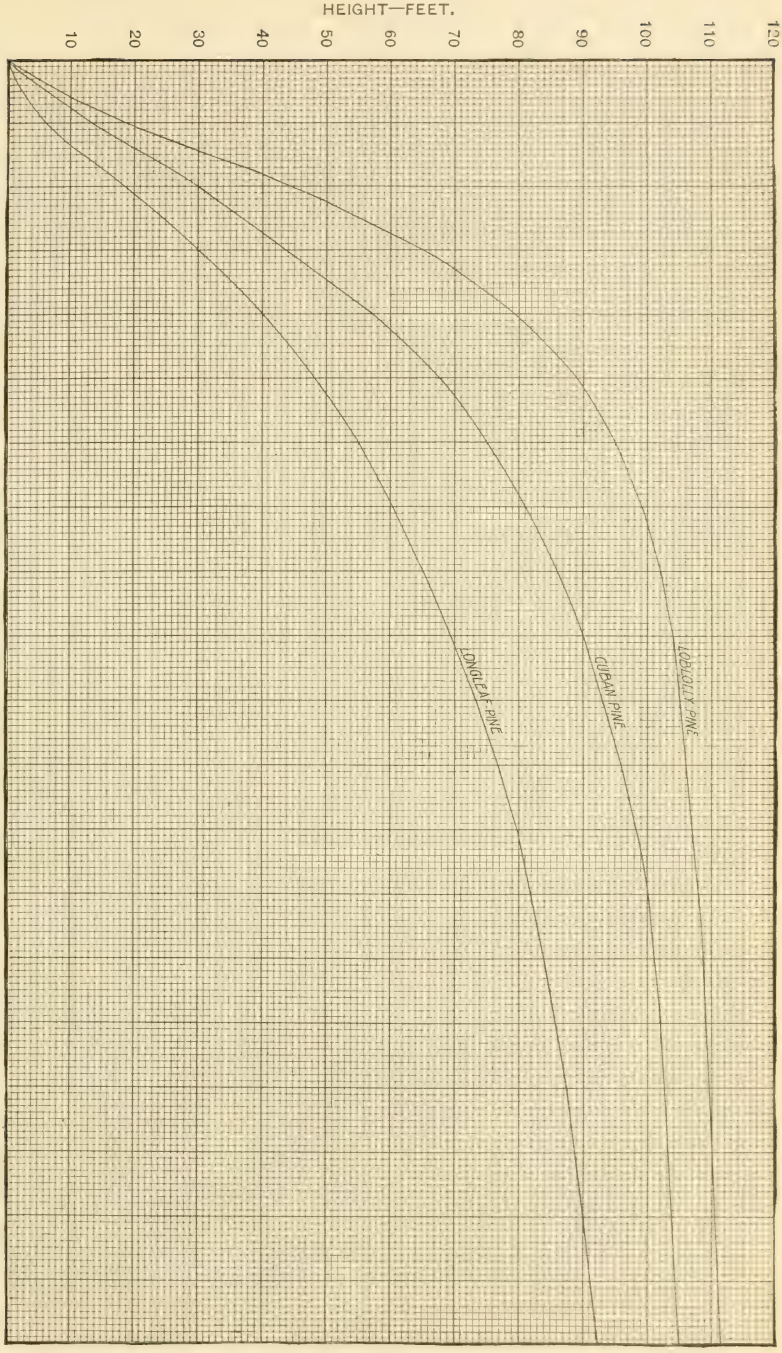


DIAGRAM 9.—Total height of Longleaf, Cuban, and Loblolly Pine on a basis of age.

annual growth in height for the first fifty years is about 11.5 inches, and for the first century about 8.8 inches.

The Cuban and Loblolly pines, like the Longleaf, vary greatly in rate of growth under different conditions. The Cuban Pine attains its maximum annual growth in height—18 inches—by the thirtieth year. By the fiftieth year the annual growth has fallen to 12 inches, and by the hundredth year to 3.6 inches. The mean annual growth in height for the first fifty years is 16 inches. For the first century it is about 11 inches.

The height growth of Loblolly Pine is very rapid at first. Between the tenth and twentieth years the annual growth is 30 inches. It then falls off rapidly. By the fiftieth year it has sunk to 12 inches, and by the hundredth year to 1.2 inches. The mean annual growth for the first fifty years is 21.4 inches; for the first century, 12.6 inches.

The following table and diagram (10) show the diameter at breast height of Longleaf, Cuban, and Loblolly Pine for successive ten-year periods from 10 to 240 years:

TABLE 16.—*Diameter breasthigh on a basis of age.*

Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.	Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.
Years.	*Inches.*	*Inches.*	*Inches.*	*Years.*	*Inches.*	*Inches.*	*Inches.*
10	.....	.....	.....	110	14.1	18.3	23.3
20	3.4	4.0	6.2	120	14.9	19.2	24.2
30	5.0	6.2	9.6	130	15.7	20.1	25.0
40	6.4	8.3	12.7	140	16.4	20.9	25.7
50	7.8	10.4	15.2	150	17.1	21.7	26.5
60	8.9	12.2	17.3	160	17.8	22.4	27.3
70	10.0	13.7	19.0	170	18.5	23.1	28.0
80	11.1	15.0	20.4	180	19.2	23.7	28.7
90	12.2	16.2	21.5	190	19.9	24.4	29.4
100	13.2	17.3	22.4	200	20.5	25.0	30.2

The rate of growth in diameter of Longleaf Pine is slow compared with the other pines. Assuming a future cutting limit of 12 inches in diameter breasthigh, Longleaf Pine becomes merchantable at an age of 90 years, Cuban Pine at 60 years, and Loblolly Pine at 38 years. For the first one hundred years Longleaf Pine grows in diameter at the rate of 1 inch in seven and one-half years, Cuban Pine at the rate of 1 inch in six years, and Loblolly Pine at the rate of 1 inch in four and one-half years.

On situations suited to its growth, Loblolly Pine should be favored in the cutting wherever it contends for possession of the ground with the other pines. This working plan recommends that, in lumbering, the trees be marked by a forester for removal. The diameter limits recommended are not to be rigidly adhered to; on the contrary, the forester will raise or lower the limit according to the silvicultural con-

ditions. Usually the question will be of heavier or lighter cuttings. At the same time, marking affords an opportunity to favor the species best suited to a particular situation. In general, however, the condi-

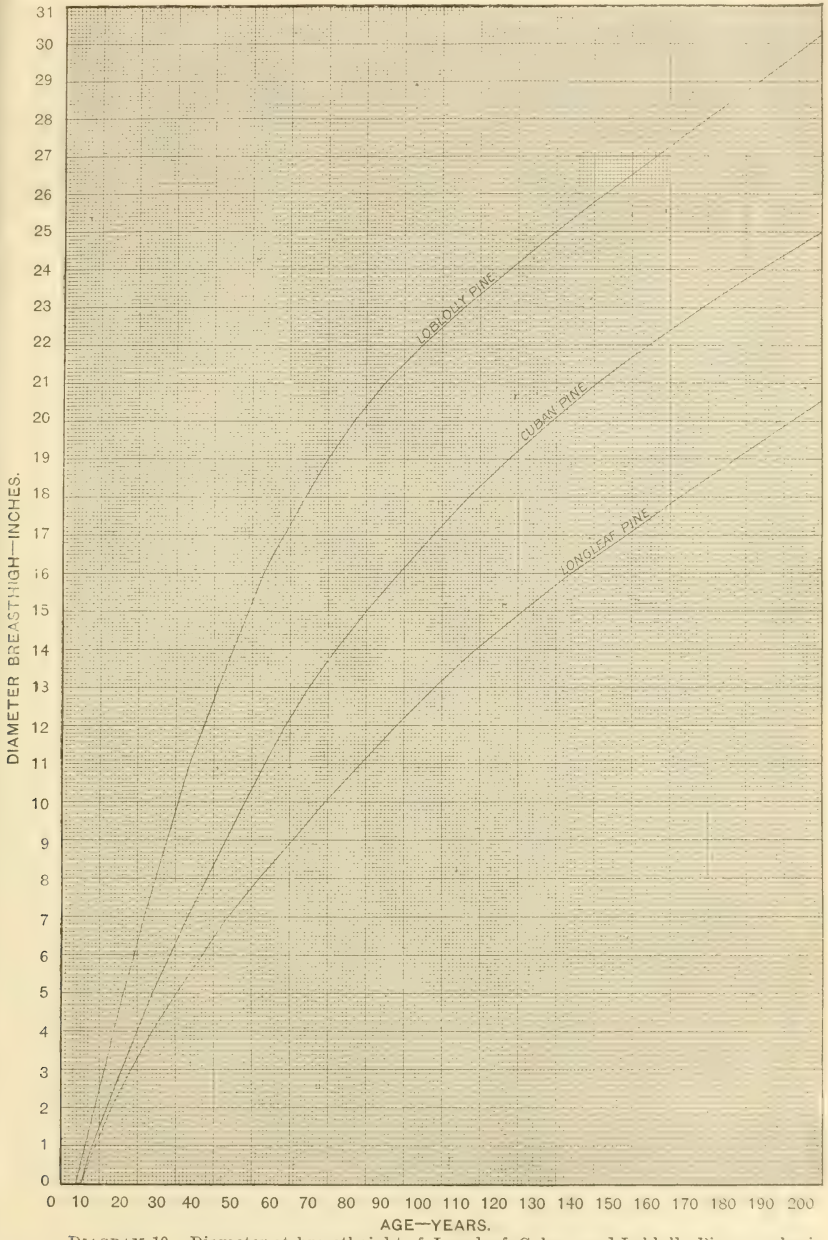


DIAGRAM 10.—Diameter at breastheight of Longleaf, Cuban, and Loblolly Pine on a basis of age.

tion of the forest is such that the question of favoring one species is of minor importance. In most cases the urgent requirement is to secure the return of pine to waste pine lands.

The following table and diagram (11) show the merchantable volume in board feet by the Two-thirds Rule of Longleaf, Cuban, and Loblolly Pine for successive ten-year periods from 40 to 250 years:

TABLE 17.—*Total merchantable volume on a basis of age.*

Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.	Age.	Longleaf Pine.	Cuban Pine.	Loblolly Pine.
Years.	*Board feet.*	*Board feet.*	*Board feet.*	*Years.*	*Board feet.*	*Board feet.*	*Board feet.*
40	.....	.....	110	150	220	410	740
50	.....	.....	200	160	245	450	790
60	.....	55	275	170	270	490	840
70	.....	100	345	180	300	525	890
80	50	140	400	190	325	565	945
90	75	180	455	200	355	605	1,000
100	100	220	500	210	390	650	1,060
110	125	260	550	220	420	690	1,115
120	145	295	595	230	455	735	1,170
130	170	335	645	240	485	775	1,225
140	195	375	690	250	520	820	1,280

CYPRESS AND THE SWAMP HARDWOODS.

Cypress must have a large and constant supply of soil moisture. Surface water is not essential, but the tree will not develop on situations where the subsoil dries out. On Cypress ponds, shallow swamps, and situations where the soil is subject to drying out it is small and unsound, and in all the high parts of the swamps gives way entirely to the swamp hardwoods.

The Cypress seeds frequently and abundantly. It is tolerant, and young growth is fairly common in favorable situations. Seedlings are seldom found. It grows to large dimensions on these lands. The largest trees now standing are between 4 and 5 feet in diameter, but there are stumps which measure 8 or 9 feet in diameter. It is very apt to be unsound; even logs sound at both ends often turn out to be more or less rotten when sawed.

The Sweet Gum is the largest and most abundant of the swamp hardwoods. It occurs throughout the swamps. Small trees are often found on moist flats which approach a swampy condition. It reaches its best development on soil which is always moist, standing close to Cypress in its power to withstand excessive moisture. The size of the trees falls off greatly as the edges of the swamp are approached and true swamp conditions fail. The Sweet Gum endures a considerable amount of shade, and is one of the commonest trees in the young growth.

The Black Gum is distributed in much the same manner as the Sweet Gum, but is much less common. It is tolerant of shade. Much of the lumber is unsound.

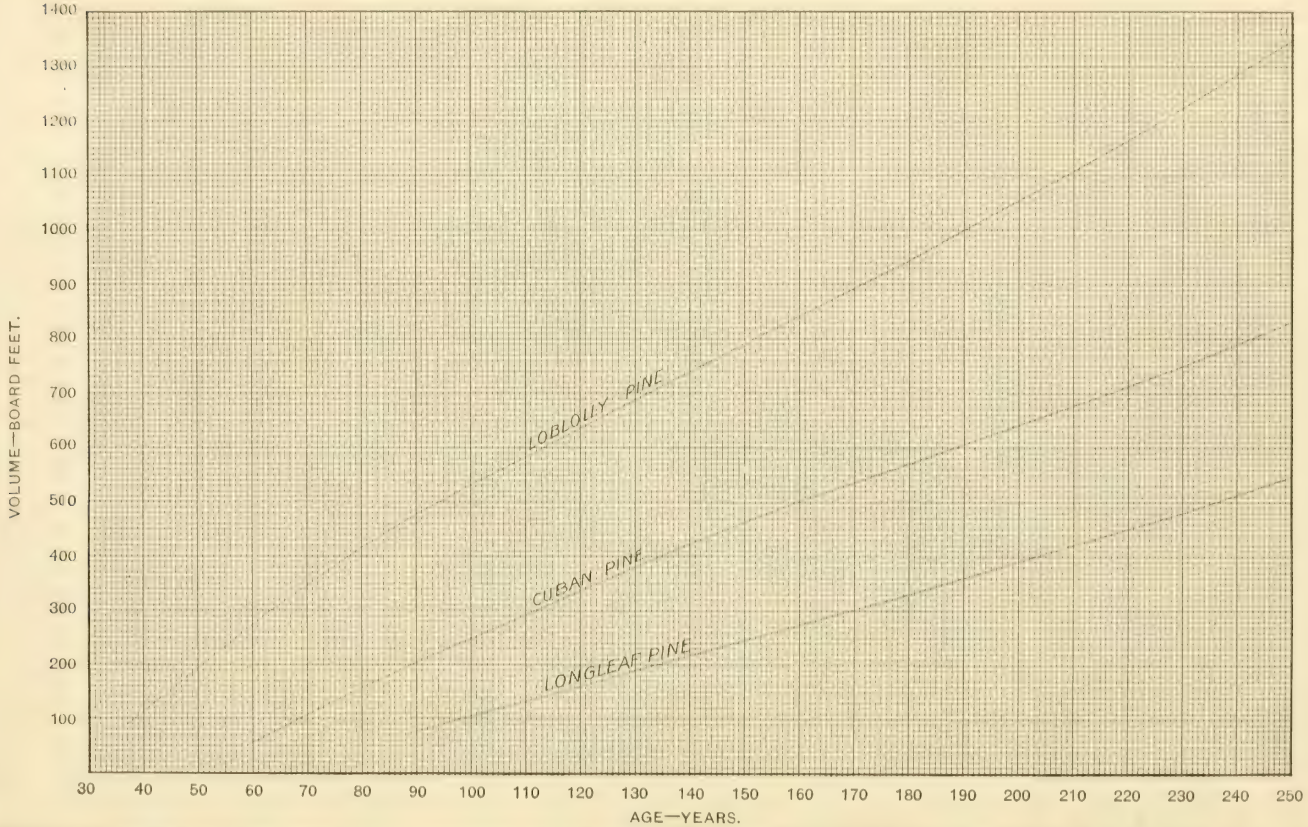


DIAGRAM 11.—Total merchantable volume of Longleaf, Cuban, and Loblolly Pine, in board feet by the Two-thirds Rule, on a basis of age.

Tupelo also requires a great amount of moisture in the soil. It is a tolerant tree, but not so tolerant as the other gums. The lumber is sound.

The oaks reach their best development in localities where the water is sufficient to keep the soil moist during the entire year, but which are not subject to constant overflow. They really form a distinct forest type, but are of too limited occurrence to be important. Water Oak is the largest and most abundant of the oaks on these lands. Willow Oak, Cow Oak, and Live Oak are also found. All except the Live Oak occur only on swampy flats. They endure considerable shade.

There is considerable merchantable Ash in certain parts of the Savannah River swamp, and Ash often comes up in windfalls and other openings in the swamp forest. Its distribution is comparatively limited, however. The ashes are intolerant of shade.

Hickory occurs in the swamps scattered by single trees. It is generally small and overtopped by the other trees, and is commercially unimportant. It bears considerable shade.

Cottonwood is occasionally found in the swamps. It is very intolerant of shade, and no young growth occurs except in openings.

LIST OF IMPORTANT TIMBER TREES FOUND ON THE TRACT.

Longleaf Pine	*Pinus palustris* Mill.
Loblolly Pine	*Pinus tæda* Linn.
Cuban Pine	*Pinus heterophylla* (Ell.) Sudw.
Pond Pine	*Pinus serotina* Michx.
Cypress	*Taxodium distichum* (Linn.) Rich.
Sweet Gum	*Liquidambar styraciflua* Linn.
Black Gum	*Nyssa sylvatica* Marsh.
Tupelo	*Nyssa aquatica* Linn.
Water Oak	*Quercus nigra* Linn.
Willow Oak	*Quercus phellos* Linn.
Water Ash	*Fraxinus caroliniana* Mill.

THE WORKING PLAN.

OBJECT OF THE CLUB.

The lands of the Okeetee Gun Club are held primarily as a game preserve. There is, however, an admirable sentiment against allowing land not required as open cover for quail to lie idle, it being fully understood that the application of practical forestry to the tract will in no way interfere with its utilization as a game preserve. In fact, by the adequate protection of the lands from fire—the salient feature of the management advised—the conditions for the propagation of quail and other game would be notably bettered. The raising of field crops, except on a small scale, is out of the question on account of the poverty of the soil. Recognizing that these lands are natural pine lands, better fitted for the growing of pine than for any other purpose,

it is the desire of the club to adopt a plan of management in consequence of which the large amount of pine second growth already on the ground may be fostered, and the further reseeding of waste lands may be effected. While the question of an immediate revenue from the sale of timber is of secondary importance to the club, a large part of the merchantable timber left upon the tract is mature and ought to be cut.

Mature trees in a forest are unproductive, and represent so much idle capital. Their removal will not only bring immediate returns from the sale of the timber, but will also result in an increased growth of the trees of smaller diameters, which are capable of rapid growth, but which are now held back by lack of sufficient light and space. The immediate lumbering of the trees which have been boxed for turpentine is a necessity if the timber is to be saved. It is the object of the club to cut the timber in such a way as not to destroy the productive power of the forest. The reasons for the application of practical forestry to this tract are urgent and convincing. To lumber under the methods employed in the past would be further to impair the productive capacity of the forest: to do no lumbering and enforce no effective measures against fire would be to invite further deterioration of a forest already in bad condition, and to throw away the money represented by timber already mature; to lumber conservatively under adequate fire protection would be to realize an immediate and legitimate profit, and to utilize the capacity of the lands to produce the only crop for which they are suited.

FIRE PROTECTION.

FIRE PATROL.

Without systematic effort and organization, attempts at protection against fire will be useless. The system advised provides a fire service for patrolling the tract during dangerous seasons. The organization of the fire service is based upon the present game-warden system; it aims to prevent fires and to limit their spread rather than to fight fire.

The fire service recommended consists of three wardens, each of whom will have charge of approximately 15,000 acres. The club is in a position to make it an object for its tenants and for interior property owners to join the effort to prevent fires, and to require their assistance in fighting any fires which may start.

FIRE LINES.

A small annual outlay for maintaining a system of fire lines is very desirable. Fire lines will be a great aid to effective work by the fire patrol. The Southern and the Charleston and Savannah railroads trav-

erse about 16 miles of the tract. They converge in such a manner as to be well adapted for fire lines. At present, fires are often set by sparks from the engines. It is proposed to convert the railroads into effective fire lines by burning the right of way clear of all combustible material. The law of the State of South Carolina renders railroads liable for damage to woodlands by fire, and at present they burn their rights of way, but this burning is incomplete and very unsatisfactory. The club should arrange with the railroads not only to burn the immediate right of way, but also to burn wider strips where this is necessary for protection. The railroads and swamps will then form an admirable basis for a network of fire lines. They should be connected by fire strips burned along roads and paths in such a manner as to form as complete a base as possible from which to fight fire and to limit the spread of fires which may get beyond control. The burning of such fire strips along roads can be accomplished very rapidly and safely by burning when the grass is dry, with the wind against a road which will stop the fire.

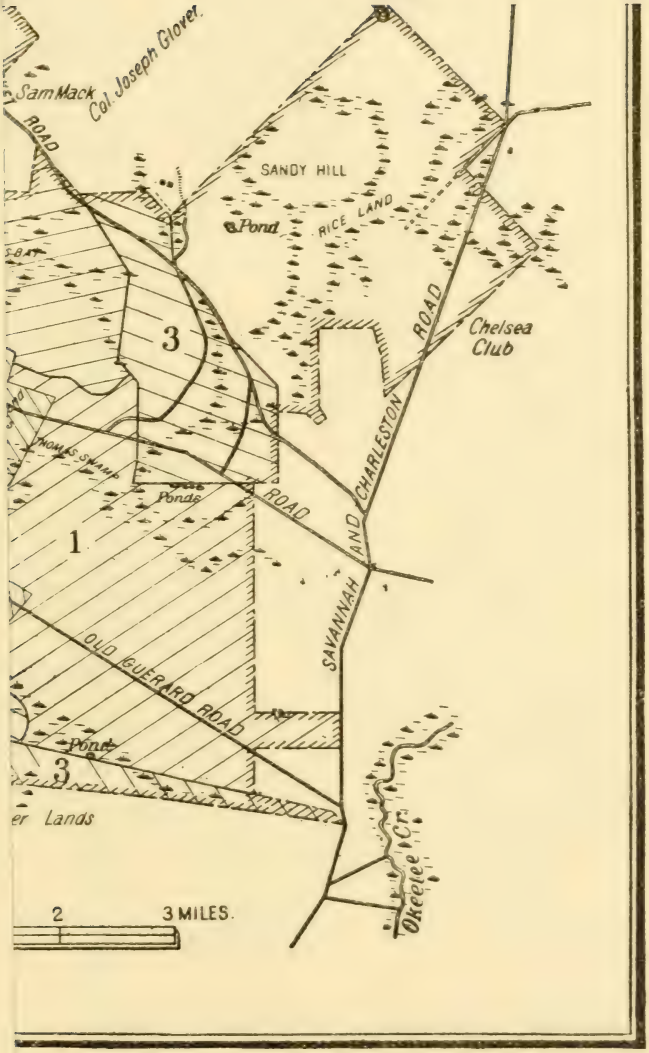
COST OF FIRE PROTECTION.

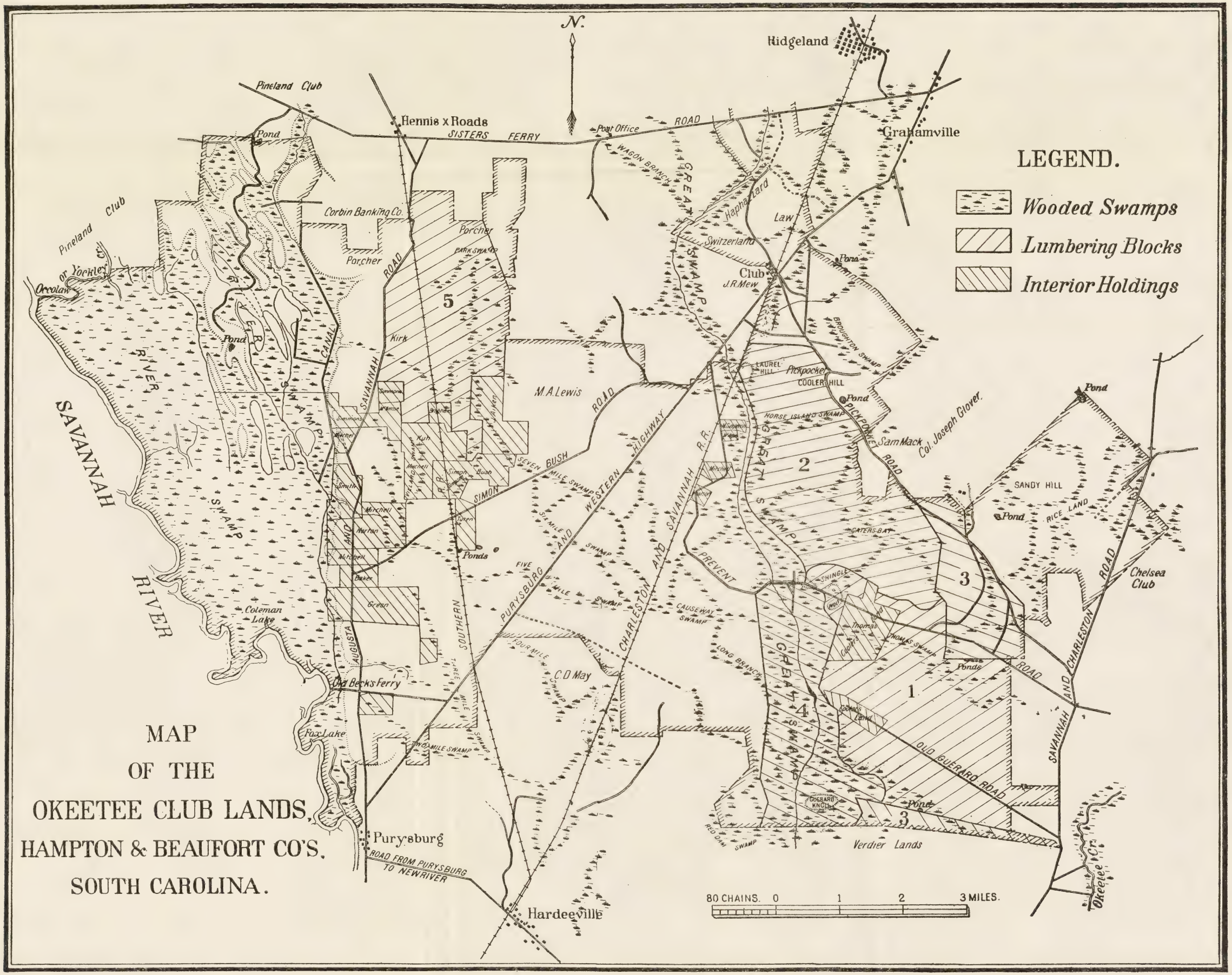
The western quarter of the tract, comprising the Savannah River Swamp, never burns over. The annual cost of thoroughly protecting the remaining 45,000 acres from fire is estimated at about $800. This estimate includes $700 to cover one-half the salaries of three fire wardens (one-half of the salaries of the men in their capacity as game wardens being properly chargeable to the existing organization for the protection of game) and the wages of such extra helpers as may be required throughout the year, and $100 to cover the cost of burning 100 miles of fire lines, at an estimated average cost of $1 per mile.

PRESENT YIELD OF MERCHANTABLE TIMBER.

The following table shows the present yield of merchantable timber on the 18,123 acres included in the five blocks of forest which were estimated for the purposes of this working plan. (See map, Pl. XIII.) The present yield was calculated by combining the tables of stand, given on pages 15 to 19, with the volume tables for the several species, given on pages 20 and 21. The table gives the yield of merchantable heartwood and sapwood of pine and the total yield of merchantable timber for all species, in board feet by the Two-thirds Rule, cutting to the diameter limits recommended for the several species. These diameter limits are:

	Inches.
Boxed pines	12
Unboxed pines	16
Cypress and hardwoods	18


Sam Mack
Col. Joseph Glover
ROAD
SANDY HILL
Pond
RICE LAND
3
Chelsea
Club
ROAD
SAVANNAH AND CHARLESTON
Ponds
ROAD
1
OLD IGUERARD ROAD
Pond
3
er Lands
Okeetee Cr.
2
3 MILES.



MAP OF THE OKEETEE CLUB LANDS, HAMPTON & BEAUFORT CO'S. SOUTH CAROLINA.

TABLE 18.—*Present yield of merchantable timber.*

BOXED LONGLEAF PINE.

[Cutting to a breasthigh diameter limit of 12 inches.]

Number of block.	Area.	Heartwood.		Sapwood.		Total.	
		Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	Acres.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
1	4,769	620.53	2,959,308	1,220.95	5,822,710	1,841.48	8,782,018
2	4,430	26.53	117,528	1.84	8,151	28.37	125,679
3	1,952	18.22	35,565	77.18	150,655	95.40	186,220
4	2,907						
5	4,065	19.51	79,308	10.37	42,154	29.88	121,462
Total	18,123	176.11	3,191,709	332.38	6,023,670	508.49	9,215,379

UNBOXED LONGLEAF PINE.

[Cutting to a breasthigh diameter limit of 16 inches.]

1	4,769	17.77	84,745	28.78	137,252	46.55	221,997
2	4,430	5.38	23,833	5.86	25,960	11.24	49,793
3	1,952	41.17	80,364	21.81	42,573	62.98	122,937
4	2,907						
5	4,065	16.65	67,782	5.35	21,748	22.00	89,430
Total	18,123	14.16	256,624	12.55	227,533	26.71	484,157

BOXED CUBAN PINE.

[Cutting to a breasthigh diameter limit of 12 inches.]

1	4,769	584.04	2,785,287	1,516.48	7,232,093	2,100.52	10,017,380
2	4,430	113.78	504,045	217.24	962,373	331.02	1,466,419
3	1,952	120.82	235,841	406.84	794,152	527.66	1,029,992
4	2,907	10.13	29,448	6.71	19,506	16.84	48,954
5	4,065	53.30	216,664	222.95	906,292	276.25	1,122,956
Total	18,123	208.09	3,771,285	547.06	9,914,416	755.15	13,685,701

UNBOXED CUBAN PINE.

[Cutting to a breasthigh diameter limit of 16 inches.]

1	4,769	22.97	109,544	59.67	284,566	82.64	394,110
2	4,430	465.62	2,062,697	789.62	3,498,017	1,255.24	5,560,714
3	1,952	33.13	64,670	113.21	220,986	146.34	285,656
4	2,907	16.35	47,529	116.54	338,782	132.89	386,311
5	4,065	48.74	198,128	102.44	416,419	151.18	614,547
Total	18,123	136.98	2,482,568	262.58	4,758,770	399.56	7,241,338

TABLE 18.—*Present yield of merchantable timber*—Continued.

UNBOXED LOBLOLLY PINE.

[Cutting to a breasthigh diameter limit of 16 inches.]

Number of block.	Area.	Heartwood.		Sapwood.		Total.	
		Average yield per acre.	Total yield.	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
	Acres.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
1	4,769	141.68	675,672	573.51	2,735,069	715.19	3,410,741
2	4,430	260.77	1,155,211	690.55	3,059,137	951.32	4,214,348
3	1,952	5.44	10,619	65.58	128,012	71.02	138,631
4	2,907	77.69	225,845	88.92	258,490	166.61	484,335
5	4,065	991.48	4,030,366	4,553.70	18,510,791	5,545.18	22,541,157
Total	18,123	336.46	6,097,713	1,362.44	24,691,499	1,698.90	30,789,212

UNBOXED POND PINE.

[Cutting to a breasthigh diameter limit of 16 inches.]

1	4,769			140.51	670,092	140.51	670,092
2	4,430			58.15	257,605	58.15	257,605
3	1,952			97.00	187,344	97.00	187,344
4	2,907						
5	4,065			27.85	113,210	27.85	113,210
Total	18,123			67.43	1,228,251	67.43	1,228,251

CYPRESS.

[Cutting to a breasthigh diameter limit of 18 inches.]

Number of block.	Area.	Average yield per acre.	Total yield.
	Acres.	*Board feet.*	*Board feet.*
1	4,769	568.13	2,709,411.97
2	4,430	268.10	1,187,683.00
3	1,952	391.41	764,032.32
4	2,907	4,710.82	13,694,353.74
5	4,065		
Total	18,123	1,012.83	18,355,481.03

GUMS.

[Cutting to a breasthigh diameter limit of 18 inches.]

1	4,769	385.85	1,840,118.65
2	4,430	184.93	819,239.90
3	1,952	30.21	58,969.92
4	2,907	10,080.55	29,304,158.85
5	4,065	300.15	1,220,109.75
Total	18,123	1,834.28	33,242,597.07

TABLE 18.—*Present yield of merchantable timber*—Continued.

SWAMP OAKS.

[Cutting to a breasthigh diameter limit of 18 inches.]

Number of block.	Area.	Average yield per acre.	Total yield.
	Acres.	*Board feet.*	*Board feet.*
1	4,769	.....	.....
2	4,430	30.32	134,317.60
3	1,952	.....	.....
4	2,907	5.19	15,087.33
5	4,065	435.51	1,770,348.15
Total	18,123	105.93	1,919,753.08

The following table gives the present yield of merchantable Pine and Cypress on Blocks 1 to 5:

TABLE 19.—*Present yield of merchantable Pine and Cypress.*

[Cutting boxed Pine to a breasthigh diameter limit of 12 inches; unboxed Pine to a breasthigh diameter limit of 16 inches; Cypress to a breasthigh diameter limit of 18 inches.]

Number of block.	Area.	Average yield per acre.	Total yield.
	Acres.	*Board feet.*	*Board feet.*
1	4,769	5,495.02	26,205,749.97
2	4,430	2,903.44	12,862,241.00
3	1,952	1,391.81	2,716,812.32
4	2,907	5,027.16	14,613,953.74
5	4,065	6,052.34	24,602,762.00
Total	18,123	4,469.54	81,001,519.03

FUTURE YIELD.

The policy of the owners and the condition of the forest combine to render considerations of future yield of very minor importance in the preparation of this working plan. From the standpoint of the owners, the feasibility of management depends neither on securing a sustained yield for an established mill nor on the certainty of being able to realize a profitable return on the capital invested in the land, but on the possibility of securing more in the long run under management than without it. From the standpoint of the forest, the first and for the time being almost the only question is, not how soon it will produce a given amount of timber at its present rate of growth, but how it can be made to produce its full yield. The problem presented on these lands is the management of a forest in poor condition as the result of maltreatment, together with the utilization of the merchantable timber which it contains. The management advised is based,

therefore, not upon calculations of future yield, but entirely upon silvicultural and market considerations.

The abnormal condition of the forest renders impracticable accurate estimates of its production, even in the immediate future. Boxed trees can not properly be used as a basis for predictions of future yield, because it is probable that they will soon fall as a result of damage from wind, fire, or disease, while the prevalence of fires during a long period has rendered the representation of small trees very irregular. The first object to be gained is, through protection from fire and through careful cutting to utilize fully the productive capacity of the natural pine lands. Only after these have been restored to something like their normal condition will it be possible to make predictions of any degree of accuracy concerning the return which they can be expected to make in the long run, or to prepare a working plan based on annual production or recurrent periods of equal yields.

The forests of Loblolly Pine, owing to the fact that they have not been culled nor the trees boxed, more nearly approach a normal condition than the forests in which Longleaf and Cuban Pine predominate. An estimate is therefore given of the yield which may be looked for on those parts of the area included in the valuation surveys on which this tree makes its largest showing, as the growth now in sight matures.

The following table shows for Loblolly Pine in Blocks 2 and 5 the present yield per acre, the future yield per acre at ten-year periods, and the number of years which must elapse between equal cuts, cutting to breasthigh diameter limits of 12, 14, and 16 inches:

TABLE 20.—*Future yield of Loblolly Pine on Blocks 2 and 5.*

Number of block.	Cutting limit: diameter breast-high.	Average present yield per acre.	Average yield per acre obtainable at the end of 10-year periods.					Interval required between equal cuts.
			10 years.	20 years.	30 years.	40 years.	50 years.	
	Inches.	*Board feet.*	*Board feet.*	*Board feet.*	*Board feet.*	*Board feet.*	*Board feet.*	*Years.*
2	12	1,062.94	83.40	260.50	453.92	633.72	799.21	68
	14	1,023.64	99.92	285.42	557.42	792.79	978.84	52
	16	961.32	103.57	281.77	655.22	946.06	1,194.70	40
5	12	6,198.76	425.40	978.78	1,750.18	2,864.18	3,721.38	85
	14	5,956.06	600.20	1,377.98	2,432.38	3,835.83	4,817.15	62
	16	5,545.18	588.28	1,695.49	3,036.46	4,081.01	6,042.03	47

MARKET AND TRANSPORTATION.

The mills on the tract have not been equipped to utilize sap logs profitably, and the waste of merchantable timber of this description has been enormous. Owing to the fact that a large part of the dimension timber has been culled from the forest, much of the remaining pine will cut into sap logs. Such material can be most profitably

handled in manufactured lumber for inside finish, and would have a considerable standing only in the market for North Carolina pine. Savannah, the nearest market for the timber from these lands, handles mostly construction timber of large dimensions, known as "merchantable." The sapwood timber from these forests could not be sold there to advantage.

If the club were in a position to put up a thoroughly modern mill, equipped with dry kilns and planing and lath mills, and were willing to install a complete system of transportation and to undertake the large business of lumbering the whole tract, a mill situated on the southern boundary of the tract, near Hardeeville, at the junction of the Southern and the Charleston and Savannah railroads, would undoubtedly be a very profitable investment. This location has many natural advantages as the site for a large mill. A short spur from the Southern Railroad to Becks Ferry, on the Savannah River, would greatly facilitate the logging of Cypress in the Savannah River Swamp, and would also open a water route for the shipment of the product of the mill. With the construction of a temporary railroad from a point on the Charleston and Savannah Railroad to Okeetee Creek, traversing the zone of timber on the east side of the tract, the mill would be very accessible to all the timber belonging to the club. This temporary railroad should be built along the Great Swamp, so that a steam skidder could run a line into the swamp on one side and could log the pine on the other. Outlying pine timber could be reached in favorable weather with timber carts. The railroad and steam skidder would overcome the difficulty of logging in wet weather—a serious problem of economical lumbering on these lands on account of the poor bottom. Another water route is through Okeetee Creek, where there are 17 feet of water at low tide, into Broad River. The mill would stand at the junction of two railroads operating separate tracks northward.

As it is the preference of the club not to undertake this enterprise on its own account, it is advised that the timber be sold either for a lump sum or on a stumpage basis, with or without the right to build a mill on the tract.

RECOMMENDATIONS FOR LUMBERING.

The tables of present yield include only the portion of merchantable timber standing upon these lands which was actually estimated in connection with the preparation of the working plan. In addition to this there is a large amount of Cypress in the Savannah River Swamp and in the unsurveyed portion of the Great Swamp, and a considerable amount of pine timber in scattered bodies throughout the tract. Much of this timber is so scattered that it would be unprofitable to lumber it; but the conclusion reached by the Bureau of Forestry, after a careful examination of the tract, is that the condition of the forest

from a silvicultural standpoint would be benefited by extending the lumbering to cover as much of the tract as possible, provided the cutting be restricted to the diameter limits recommended for the several species. If the whole tract is lumbered, the logging equipment and facilities for transportation can be on a much larger scale than would be possible if only the five blocks surveyed were lumbered. In consequence, the cost of logging would be materially cheapened and the operations would be made much more profitable.

DIAMETER LIMITS.

All boxed trees should be cut. Trees 12 inches and over in diameter can be sold as merchantable timber; smaller boxed trees should be used for railroad ties and for fuel for logging operations.

The cutting limit recommended for unboxed Pine is 16 inches, for Cypress and hardwoods 18 inches. These diameter limits, however, should not constitute a hard and fast rule; a forester should superintend the marking of all trees for removal, with reference to the silvicultural needs of the forest.

RULES FOR LUMBERING.

It is recommended that the following rules for lumbering, embodying the recommendations for logging, be included in the contract for the sale of timber:

(1) No trees shall be cut which are not marked. All marked trees shall be cut.

(2) No stump shall be cut higher than 6 inches above the swell of the roots, and in no case shall Pine be cut more than 18 inches above the ground.

(3) All cuts shall be made with a saw.

(4) All logs shall be cut of such lengths as will completely utilize all merchantable timber in each tree down to 8 inches in diameter at the top end.

(5) Whenever practicable, unboxed Pine and Cypress shall not be used for skids, piling, culverts, railroad ties, or fuel, or for any purpose connected with logging operations.

(6) All trees shall be immediately lopped of limbs and the brush piled for burning in such a position as not to endanger young growth.

(7) Care must be taken not to injure young Pine trees in felling timber.

It is recommended that the burning of tops be done by a fire warden or other employee of the club.

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